May 21, 2024

Fremont County
Department of Planning and Zoning
Attn: Dan Victoria
615 Macon Avenue, Room 210
Canon City, CO 81212

RE: CDP Re-Review – Penrose RV & Boat Storage, 17225 SH 115, Penrose, CO

Hello Mr. Victoria,

Please find included for your re-review of the above-mentioned project the following amended documents:

1. Revised CDP Application, referencing updates to the project, which include the following:
    a. Removal of Caretaker's Unit, therefore the removal of the associated design facets:
        i. Septic System
        ii. Parking
        iii. Site lighting references
    b. Removal of Site Fencing on the exterior perimeter of the property
    c. Addition of a locking hose bib for Ownership-only use
2. Revised Drainage Report
3. Revised Water Demand Memo
4. Revised Water Resources Form
5. Revised Project Narrative
6. Revised Civil Construction Drawings
7. Project Perspectives

Our hope is that with a standard two week review cycle, we will be able to meet the deadline to submit to BOZA by June 10th for the June 18th meeting.

Thank you in advance for your time and consideration.

Nicole Suttle
Preconstruction Project Engineer

FREMONT COUNTY
DEPARTMENT OF PLANNING AND ZONING

615 MACON AVENUE, ROOM 210, CAÑON CITY, COLORADO, 81212
Telephone 719-276-7360 / Facsimile 719-276-7374
Email: Planning@fremontco.com

LAND USE APPLICATION
SPECIAL REVIEW USE, CONDITIONAL USE PERMIT, COMMERCIAL DEVELOPMENT PLAN

It is recommended that the applicant schedule an appointment with a Department of Planning & Zoning Representative prior to application preparation and submittal to discuss the project as currently planned and future project proposals.

Project Name: Penrose RV & Boat Storage
Site Address: 17225 SH 115, Penrose, CO 81240
Applicant(s)
Name(s) Anna Fluckey
Address 650 Innovation Cir., Windsor, CO 80550
Phone 970-686-6300   Fax
Email anna.fluckey@mccauleyconstructors.com
Owner(s)
Name(s) John Edgar, EPCOCO REI One, LLC
Address 3455 Fillmore Heights, Colorado Springs, CO 80907
Phone 719-651-5563   Fax
Email john@edgartruck.com
Authorized Representative / Agent / Consultant (*if other than owner*)
Name(s) Anna Fluckey
Address 650 Innovation Cir., Windsor, CO 80550
Phone 970-686-6300   Fax
Email anna.fluckey@mccauleyconstructors.com

Type of Application / Application Fee (*There maybe additional fees for publications or professional reviews*):
☐Special Review Use Permit $1,800 ☐Major Modification to existing permit $500
☐Conditional Use Permit $1,750 ☐Major Modification to existing permit $500
☒Commercial Development Plan $1750 ☐Major Modification $500

The applicant shall provide **one (1) original document, and an electronic copy (either CD or flash/thumb drive) of the application**, site plan (**2 COPIES**) and all of its attachments (*copies of deeds, contracts, leases etcetera are acceptable*) at the time of application submittal along with the **application fee** set as per Resolution of the Board. Submittals shall be made to the Department no later than 3:00 pm on the submittal deadline date.

Process & Requirements Overview

Any application which is not complete or does not include all minimum submittal requirements will be rejected by the Fremont County Department of Planning and Zoning (Department). Further, any application that is inadequate or incomplete, may be subject to postponement of placement on an agenda of the Fremont County Planning Commission (Commission), pending receipt of an adequate and complete application.

Upon receipt of a complete application, the Department will review the application and all attachments and prepare a Department Submittal Deficiency and Comment Letter (D & C Letter), which will state the submittal deficiencies which must be addressed by the applicant, Department comments and/or questions about the application, and the number of revised application packets to be supplied to the Department for placement on an agenda of the Commission. An additional full application fee may be charged to the applicant, as per Resolution approved by the Board of County Commissioners (Board), if all deficiencies as per the initial D & C Letter are not adequately addressed or provided. Each subsequent D & C Letter, based on resubmitted items, will result in another full application fee. All such fees shall be paid along with the deficiency submittal, prior to any further review of the application.

The Department, Commission, and/or Board may require additional information at any time during the application process as may be deemed necessary for thorough consideration of the application and to enable an informed final decision.

Any Land Use application for that has been submitted after the use requiring the permit has been established on the property may be subject to a penalty fee in addition to the set application fee for such permit. The penalty fee shall be equal to the initial application fee for the Land Use Application. As with all land use applications payment of associated fees do not ensure approval of the application.

If the application is approved by the Board with contingencies the contingencies shall be completed to the Department within six (6) months of the approval date, or the approval shall be deemed rescinded and the application expired, after which, re-submittal of the application, including fees, and procedural requirements, will be required.

In approving an application for Land Use, the Board may require higher standards for development than required by the Fremont County Zoning Resolution (FCZR).

Modifications, major or minor, to the Land Use Permit as approved, shall be accomplished in compliance with requirements of the Fremont County Zoning Resolution.

Applicants shall pay all application fees to the Fremont County Treasurer's Office. Upon receipt of a complete application, a Department representative will provide the applicant with a payment check list to present to the Treasurer's Office with payment.

Site & Development

(Section 1)

1. Describe the proposed type of operation to include days & hours of operation, number of employees, & machinery:

    New ground-up Pre-Engineered Metal building (PEMB) erected for the purposes of a new commercial RV & Boat Storage

    Facility. This facility is strictly Self-Storage, open to customers approximately 365 days each year, no on-site services.

    Tenancy established through telephone and email communication and documentation only.

2. Property address or schedule number: 17225 SH 115, Penrose, CO 81240

3. Have the mineral interests been severed from the subject property? O YES ⊙ NO

    a. If yes (severed) who is the mineral interest owner? Research shown, rights have not been severed

4. Is the property currently developed? ⊙ YES O NO

5. Existing types & sizes of structures: (1) Metal Sided Garage 912sf (2) Conn-ex 40'X8'

6. Proposed types & sizes of structures: (3) Commercial Industrial PEMB's total 17,970sf

7. Lot Coverage (indicate percent or square footage): Existing 2%   Proposed 28%

8. FCZR Citing 4.14.2.30   Property size (acres or square footage) 59,183sf

9. Amount of the property the use will encumber: 84.4%

10. Zone District: B-Business   Land Use Storage Facility

11. Please indicate the zone district & current land use for adjoining properties:

    a. Northerly: (ZD) B-BUSINESS   Land Use: SINGLE-FAMILY RESIDENTIAL

    b. Easterly: (ZD) AR-AGRICULTURAL RURAL   Land Use: UNDEVELOPED

    c. Westerly: (ZD) AL-AGRICULTURAL LIVING   Land Use: UNDEVELOPED

    d. Southerly: (ZD) AR-AGRICULTURAL RURAL Land Use: AUTOMOTIVE/TRUCKING COMPANY

12. Master Plan – Planning District of property: PENROSE/BEAVER PARK PLANNING DISTRICT

    (please refer to Chapter four and planning district of the Fremont County Master Plan)

13. Name(s) and type(s) of road(s) the property is accessed from:

    COLORADO STATE HIGHWAY 115   FUTURE: Access to Future "H" Street

14. Is access through adjacent properties? O YES ⊙ NO If yes, is access legally established through:

    ☐ Deed of record   ☐ Recorded Plat   ☐ Court Order   (Documentation shall be provided)

15. Estimated Traffic Count 36   (per day)   Number of access points (1) Proposed (1) Future

16. Is access from or within five-hundred feet (500') of a Colorado Department of Transportation Controlled Road:

    ☒ YES ☐ NO (If yes, CDOT approval/comments shall be required)

17. Does the property lie adjacent to or within three (3) miles of any municipal boundary lines (city/town limits)? ☐

    YES ☑ NO   Municipality Name(s) _____

18. Does the property lie within the boundaries or within ¼ of a mile of any service district?

☒ YES ☐ NO   Entity Name(s) <u>PENROSE WATER DISTRICT, FLORENCE FIRE PROTECTION DISTRICT</u>

19. Requested duration of proposed use: _____ ☑ Life of use ☐ Estimated life of use years [   ]

20. Is temporary cessation proposed: ○ YES ◉ NO   Duration: _____

21. Is buffering required: ○ YES ◉ NO (Contractor yards, Junk yards, Automobile graveyards, & Vehicle impoundment yards **require** buffering per FCZR 5.17.15)

22. Is landscaping proposed: ○ YES ◉ NO a waiver is requested

23. Total parking spaces <u>0</u> standard size <u>0</u> compact <u>0</u> ADA <u>0</u>
(Standard 9' X 18') (Compact 7' X 15') (Please refer to section 5.3 & 5.4 of the FCZR)

24. Will the parking area include lighting? ○ YES ◉ NO

25. Parking area surface type: <u>None</u> Thickness: <u>None</u>

26. Is a loading/unloading area proposed? ◉ YES ○ NO Size: <u>CONCRETE</u> Thickness: <u>6 Inches</u>

27. Will hazardous materials be stored on site? ○ YES ◉ NO

28. Will noxious weed control measures be included in the scope of the project? ◉ YES ○ NO

29. Will any equipment meeting the Colorado Revised Statute definition of Special Mobile Machinery be stored or used onsite? ○ YES ◉ NO

30. Mark all services and facilities necessary to accommodate the proposed use in addition to Fire Protection, Emergency Medical Response, & Law Enforcement: N/A

    ☐ Roadway Maintenance   ☐ Hospital   ☐ Park & Recreation

    ☐ Airport   ☐ Search & Rescue   ☐ Schools   ☐ Library

31. Utility Provider information: Please provide the name of provider below:

    a) **Water:** <u>PENROSE WATER DISTRICT</u>

    b) **Sanitation:** <u>N/A</u>

    c) **Electrical:** <u>Black Hills Energy</u>

    d) **Telephone:** <u>TBD - Cellular</u>

    e) **Refuse:** <u>N/A</u>

    f) **Irrigation Water:** _____

    g) **Natural Gas/Propane:** <u>Black Hills Energy</u>

    h) **Cable Television:** <u>TBD</u>

1. Dust and erosion control measures:

   All areas will be stabilized with buildings, pavement, or vegetation to minimize erosion and the generation of fugitive dust

   after completion of the project. During construction, industry standard erosion and dust control BMP's,

   such as vehicle tracking, silt fence, watering access areas, will be implemented

2. Noise control measures:

   Noise impact anticipated during construction is associated to typical construction activity

   Post construction - no impact is anticipated

3. Odor control measures:

   Odor impact anticipated during construction is associated to typical construction activity

   Post construction - no impact is anticipated

4. Visual impact control measures:

   Visual impact anticipated during construction is associated to typical construction activity

   Post construction-native vegetation shall be utilized to enhance the visual corridor of HWY 115

5. Wildlife/plant habitat protection measures:

   Per species list provided, protection measures N/A

6. Water quality and/or water way(s) protection measures:

   EXTENDED DETENTION BASIN - please reference Drainage Report emailed 3/26/2024.

7. Safety measures to protect adjacent properties, residents, & agricultural operations:

   An extended detention basin is proposed to reduce the 100-year discharge from the developed site and is not

   anticipated to adversely impact neighboring properties or downstream drainage conditions. In regards to the irrigation;

   the site is graded away from the Brush Hollow Supply Ditch to prevent runoff from entering the ditch.

8. Measures to protect and/or preserve archaeologically or historically significant sites:

   Per a conversation with the Owner; no discovery of any historical or archaeological significance has ever been made on

   site, nor any artifacts of such significance ever been located on this property.

9. Measures to limit or control offsite discernable vibrations:

   Little to no vibrations are anticipated during or post construction of this project.

Required Submittals Attachments
(Section 3)

1. Current Deed of Record
2. Water supply documentation: Public water source requires documentation evidencing ability to provide service. Wells require documentation of a well permit and/or documentation that the existing well is adequate for the proposed use
3. Fremont County's Colorado Division of Water Resources Information Form
4. Sanitation Documentation: Public sewer shall require documentation evidencing ability to provide service. Onsite Waste Water System (OWTS) shall require a percolation test and report and a design plan from a certified engineer. Existing OWTS systems shall require documentation that the existing system is adequate for the proposed use
5. Refuse Plan: Shall address the storage, collection, and disposal of refuse. It shall also document screening of refuse receptacles/areas. (Refuse plans require approval by the Fremont County Environmental Health Dept.)
6. Drainage Plan: Must contain all required items under FCZR 5.10 (Drainage plans require approval by the County Engineer).
7. Landscaping Plan or justification for waiver request.
8. Lighting Plan or justification for waiver request
9. Noxious Weed Control Plan or justification for waiver request. (Plans and waiver requests require approval by the Fremont County Noxious Weed Manager)
10. List of owners and mailing address for all properties located within a five-hundred (500') foot radius of the subject property
11. County Roadway Impact Analysis Form (If accessed off a county road)
12. Colorado Department of Transportation Access Permit (If accessed off a CDOT controlled road)
13. Statement indicating how the proposed use complies with "Goals Objectives, and Implementation Strategies" of the Fremont County Master Plan District
14. Statement indicating how the proposed use will be in harmony and compatible with surrounding land uses and development in the area and/or measures that can be taken to make it in harmony & compatible.
15. Fire protection plan addressing method of fire protection, location of hydrants or other means of protection. If located within a fire protection district the plan shall be approved by the District.
16. A detailed utility plan showing the proposed or existing location of all utilities.
17. Site Plan drawn to professional standards (3 hard copies 18" x 24" or 24" x 36")
18. Submittals and exhibits should be clearly identified with section and/or question number located on the bottom right hand corner, or otherwise tabbed or marked.

19. CDOT Notification form of Proposed Land Use and comments (if access is from or within 500' of a CDOT controlled road)

20. Mineral Interest Notification and certified mailing receipt. Notification & Mailing shall be completed within 30 days prior to the scheduled Planning Commission Meeting. (this is only required if the minerals interests are severed)

21. Copies of all local, state and federal licenses and/or status of applications.

22. In circumstances of Corporate Ownership, documentation evidencing whom is eligible to execute documents on behalf of the corporation

23. In circumstances where the applicant is not the owner written authorization from the owner specifying the extent to which the representation is authorized

24. In circumstances where a consultant is making application on behalf of the owner, written authorization from the owner specifying the extent to which the representation is authorized

25. In circumstances where the property owner of record is not involved in the operation or application, documentation indicating right to occupy and use the property shall be provided. (lease or similar document)

26. Buffering Plan (If required)

27. Current registration for SMM equipment or documentation that equipment is on tax rolls associated with the property, to include list of machinery.

28. List of Hazardous materials stored and/or used on site, to include location of storage and management practices

29. Copies of mining and reclamation plans (CUP's)

30. Required information set forth in FCRZ 8.13.17.1 (Airports)

31. Required information set forth in FCRZ 8.13.17.2 (Adult Uses)

32. Required information set forth in FCRZ 8.13.17.3 (Kennels)

33. Required information set forth in FCRZ 8.13.17.4 (Antennas & Towers)

Site Plan Drawing Requirements

a. Drawing Size: Minimum sheet size 18" x 24" to a maximum sheet size of 24" x 36";

b. Written and graphic scale with minimum of 1" = 200' max 1" = 50';

c. Appropriate title (SPECIAL REVIEW USE PERMIT, CONDITIONAL USE PERMIT, COMMERICAL DEVELOPMENT PLAN FOR {name};

d. Appropriate subtitle (brief description of the proposed use);

e. Boundary drawing of the property with bearings and dimensions illustrating the legal description;

f. Legal description of the property;

g. Acreage or square footage of the subject property;

h. Zoning classification of the subject property;

i. Zoning classification of the adjoining properties;

j. North Arrow;

k. Vicinity map locating the subject property in relation to surrounding areas;

l. Table indicating relationship between proposed and existing construction to remain on the property

m. Minimum lot size, maximum lot coverage, maximum building height, minimum lot width, minimum setback requirements (Front, Two sides, & Rear)

n. Size and shape of all existing & proposed structures: each structure shall be labeled/noted as existing or proposed. Dimensions from at least two property lines shall be noted;

o. Location of all parking areas to include size, dimensions, surface type & thickness, type of space (ADA, Standard, Compact) and a table specifying the minimum numbers of spaces required for each category;

p. Location of loading areas to include size, dimensions surface type & thickness;

q. Labeled access points including interior roadways with dimensions, surface type & thickness, circulation pattern, and dimensions from property lines;

r. Any proposed pedestrian areas & walkways to include dimensions, surface type & thickness;

s. Location and dimensions of refuse areas;

t. Identification and location of all drainageway, drainage facilities, including FEMA flood areas, to include dimensions from property lines;

u. Location, height & type of lighting for parking and off-loading areas;

v. Location, type, and size of all on-site identification signage (table may be used);

w. All easements (existing & proposed) to include dimensions from property lines (beginning, end, & centerline) width, and if they are to be vacated or relocated;

x. Significant natural features;

y. Soil types

z. Open space areas

aa. Legend identifying symbols and/or lines

By signing this Application, the Applicant, or the agent / representative / consultant acting with due authorization on behalf of the Applicant, hereby certifies that all information contained in the application and any attachments to the Application, is true and correct to the best of the Applicant's knowledge and belief.

The Applicant understands that required private or public improvements imposed as a contingency of approval for the application may be required as a part of the approval process.

Fremont County hereby advises the Applicant that if any material information contained herein is determined to be misleading, inaccurate or false, the Board of County Commissioners may take any and all reasonable and appropriate steps to declare null and void, any actions of the Board regarding the Application.

Signing this Application is a declaration by the applicant that all plans, drawings and commitments submitted with or contained within this Application are or will be in conformance with the requirements of the Fremont County Zoning Resolution.

Anna Fluckey	Anna Fluckey _Digitally signed by Anna Fluckey, DN: C=US, E=anna.fluckey@mccauleyconstructors.com, CN=Anna Fluckey, Date: 2024.02.27 15:45:58-07'00'_	Applicant
Printed Name Applicant Signature	Date	
John Edgar	Please see attached Owner Authorization	Owner
Printed Name Owner Signature	Date	

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FREMONT COUNTY'S
COLORADO DIVISION OF WATER RESOURCES
INFORMATION FORM FOR
SPECIAL USE, ZONING, AND OTHER LAND USE ACTIONS

The Fremont County Department of Planning & Zoning (Department) is required to submit proposed land use actions to the State Engineer's Office (SEO) at the Colorado Division of Water Resources (CDWR). The SEO is responsible for providing an opinion regarding material injury likely to occur to decreed water rights by virtue of diversion of water necessary or proposed to be used to supply the proposed land use action.

This CDWR Information Form must be filled out completely and accurately to ensure that the submittal to the CDWR regarding this proposed land use action includes the necessary information required by that agency. The CDWR has 21 days to respond to County submittals. Incomplete submittals will be returned to the County for additional information and then must be resubmitted to the CDWR.

Please note that the CDWR timeframe for review may not coincide with the County deadlines or meetings, and if the CDWR requires additional information, further delays may occur.

Attachments can be made to this application to provide expanded narrative for any application item including supportive documentation or evidence for provided application item answers. Please indicate at the application item that there is an attachment and label it as an exhibit with the application item number, a period and the number of the attachment for that item (*as an example, the first attached document providing evidence in support of the answer given at application item number 8 would be marked* - Exhibit CDWR-8.1, *the fifth attached document supporting the narrative provided for application item 8 would be marked* - Exhibit CDWR-8.5). Exhibit numbers should be placed in the lower right hand area of the exhibit.

1. Name of proposed project:___Penrose RV & Boat Storage___

2. Provide a map of proposed improvements with an identified location that includes a quarter-quarter, section, township, range and principle meridian (PLSS).

3. Legal description of subject property   A PARCEL OF LAND LOCATED WITHIN A PORTION OF THE NW 1/4 OF SECTION 28, TOWNSHIP 18 SOUTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, COUNTY OF FREMONT, STATE OF COLORADO. BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS: LOT 2, COYLE-VANEGMOND LOT LINE ADJUSTMENT, ACCORDING TO THE RECORDED PLAT THEREOF, FILED FOR RECORD ON JANUARY 23, 1996 IN BOOK 1237 PAGE 531, AS RECEPTION NO. 642721 IN THE RECORDS OF THE PUEBLO COUNTY CLERK AND RECORDER, COUNTY OF PUEBLO, STATE OF COLORADO.

4. What is the size of the existing parcel? _59,183_ ☐ Acres --- ☒ Square feet

5. What are the proposed uses of the subject property?
   ☐ Residential Only
   ☒ Commercial
   ☐ Commercial and Residential

6. What are the current uses of water on this parcel? Domestic

   a. Are there any established uses that require water? ☐ Yes --- ☒ No

   b. Number of existing homes: No existing home, but has a comm/res water designation for this development

If one or more, date this use was established: __2019__

c. Home lawn / garden irrigation: ☐ Yes --- ☒ No

If yes, amount: _____ ☐ Acres --- ☐ Square feet
Date this use was established: _____

d. Livestock watering: ☐ Yes --- ☒ No

If yes, commercial or non-commercial livestock? *(Circle one)*

If yes, date this use was established: _____

e. Other uses: _____
Dates established: _____

7. What will be the proposed uses of water for this parcel? Domestic

a. Number of proposed homes (including the home above if it will remain): _0_

b. Lawn / garden watering, amount: _____ ☐ Acres --- ☐ Square feet

c. Livestock watering: ☐ Yes --- ☒ No

If yes, commercial or non-commercial livestock? *(Circle one)*

d. Number of Employees per day: _0_   Number of days open per year: _365_

e. Number of Customers per day: _13_   Number of days open per year: Site is self-serve, so approx. 365

f. Bed / Breakfast Customers per day: _N/A_   Number of days open per year: _N/A_

g. Describe other water needs: _ TBD - This site is under consideration for a
_____ landscape waiver request as well as a BOZA
_____ Variance for a reduced set-back, which will
_____ drastically reduce the amount of landscaped area.
_____

8. Source of water for the uses described above: *(If more than one source is utilized for parcel, describe which sources will supply which proposed uses)* Private: Penrose Water District

_____

a. Is Municipal water available to parcel: ☐ Yes --- ☒ No

b. Is water available to parcel from an independent water district? ☐ Yes --- ☒ No

c. Are the uses described above proposed to be provided water by a municipality?

☐ Yes -- ☒ No

Name of provider: _Penrose Water District_

d. Is water hauled: ☐ Yes --- ☒ No

e. Is there an existing permitted well?: ☐ Yes --- ☒ No

    If yes, permit number: _____

f. Is there a Substitute Water Supply Plan? *(Substitute water supply plans provide water users a mechanism to replace out-of-priority depletions on an interim basis.)*
    ☐ Yes --- ☒ No

    If yes, name of plan: _____

g. Is there an unregistered well? ☐ Yes --- ☒ No

h. Is there a Surface Spring? ☐ Yes --- ☒ No

    If yes, Court Adjudication Number and Spring Name: _____

9. What is the Waste Water Method?
    ☐ Municipal
    ☒ Septic with Leach Field
    ☐ Closed Vault, Waste Water hauled to: _____

By signing this form, the Applicant, or the agent/representative acting with due authorization on behalf of the Applicant, hereby certifies that all information contained in the form and any attachments to the form, is true and correct to the best of Applicant's knowledge and belief.

Fremont County hereby advises Applicant that if any material information contained herein is determined to be misleading, inaccurate or false, the Board of Commissioners may take any and all reasonable and appropriate steps to declare actions of the Department regarding the Application to be null and void.

Signing this form is a declaration by the Applicant to conform to all plans, drawings, and commitments submitted with or contained within this form, provided that the same is in conformance with the Fremont County Zoning Resolution.

Anna Fluckey	, Anna Fluckey	Digitally signed by Anna Fluckey DN: C=US, E=anna.fluckey@mccauleyconstructors.com, CN=Anna Fluckey Date: 2024.02.20 08:38:13-07'00'
Applicant Printed Name	Signature	Date

John Edgar	, Please see attached Letter of Authorization	
Property Owner Printed Name (If different from applicant)	Signature	Date

May 20, 2024

Fremont County
Department of Planning and Zoning
615 Macon Avenue, Room 210
Canon City, CO 81212

Re: Penrose RV & Boat Storage, 17225 SH 115, Penrose, CO

To whom it may concern:

For your consideration, is the above-referenced project, outlined below. Thank you in advance.

Introduction:

The Penrose RV & Boat Storage project envisions the transformation of Lot 2 within the Coyle-Vanegmond Lot Line Adjustment Subdivision into a modern and efficient storage RV facility. Situated on a 1.36-acre site zoned B – Business Zone District, this development aligns with the County's vision for "uniform, steady growth." The primary goal is to not only contribute significantly to the economic development of Fremont County but also to ensure harmony with the historic and scenic attributes of the territory.

Preservation of Natural Landscape:

The natural landscape within and surrounding the project site is unique to the Penrose region, setting it apart from the diverse plant communities prevalent throughout Colorado. In adherence to a preservation-oriented approach, the landscape design will endeavor to respect the integrity of the existing natural surroundings, integrating indigenous plant materials. The ultimate design of the landscape plan will contemplate the incorporation of native plant specimens that not only enhance ecological authenticity but also demonstrate a conscientious approach to water conservation. Additionally, our design will strive to enhance the visual corridor along highway 115. The proposed site layout and building configuration are planned to minimize impacts to neighboring property owner's views and frame views with enhanced landscape screening of the natural landscape.

Compatibility with Neighboring Uses:

Acknowledging the importance of community integration, the Penrose RV & Boat Storage project is designed with a keen understanding of the existing land uses in the vicinity. Neighboring businesses, such as WD Trucking and Silverline Trailers, have impacted our design decisions, ensuring architectural site design with the local economic ecosystem in mind. This compatibility enhances the overall functionality and acceptance of the storage facility within the community. The facility will be screened and secured using wrought iron fencing and gates.

Collaborative Services and Development:

In an effort to enrich the surrounding area, the Penrose project extends its services in collaboration with neighboring businesses and developments. Notably, the integration of services aligns with the establishment of a new Recreational Vehicle Park in the area. The project contributes not only to its own success but also to the broader enhancement of the local recreational vehicle storage and economic landscape.

Strategic Accessibility:

Accessibility is paramount to the success of the Penrose RV & Boat Storage project. A planned new entry from Hwy 115, currently under review for CDOT approval, ensures ease of access for both clients and service providers. This access point not only enhances the project's functionality but also mitigates potential traffic concerns, demonstrating our commitment to responsible, safe and efficient development.

Sustainable Infrastructure:

The Penrose project recognizes the importance of responsible resource utilization. Existing water services, tapped and accessible at the project site, are integrated into the development. These services are currently invoiced to the property owner on a regular billing cycle. The project will be designed to meet all local building and energy compliance codes.

Lighting and Photometric Design:

Our commitment to creating a secure and inviting environment extends to the realm of lighting and photometric design. Thoughtful placement of lighting fixtures, adhering to industry best practices, ensures both safety and aesthetic appeal throughout the storage facility. The design incorporates energy-efficient (LED) lighting solutions that not only minimize environmental impact but also contribute to operational cost-effectiveness. A comprehensive photometric analysis will be conducted to optimize light distribution, preventing glare and shadows while enhancing visibility and safety for the clients and staff during all hours of operation.

Fire Protection:

A new hydrant is proposed near the site entrance, as there are no other hydrants near-by. This new proposed hydrant shall be the provided method of fire protection.

Refuse Disposal:

No on-site refuse disposal services shall be provided.

Conclusion:

In conclusion, the Penrose RV & Boat Storage project will offer a needed amenity to the area; it is a harmonious integration of thoughtful design, community collaboration, and advanced lighting solutions, by addressing the economic needs of Fremont County and respecting the historical and scenic qualities of the area.

TECHNICAL MEMORANDUM

TO: Penrose Water District

FROM: Civil Resources, LLC

DATE: May 20, 2024

RE: Penrose RV & Boat Storage
     17225 SH 115
     Water Demand Memo

This memorandum discusses the estimated domestic and irrigation water use for the proposed Penrose RV & Boat Storage project located 17225 SH 115. The project includes the construction of three (3) indoor storage garages. A secure hose bibb will be provided for property maintenance use. The hose bibb will not be available for filling RVs or other tenant use.

The Penrose Water District (District) currently serves this Site with a 3/4 x 5/8 domestic service. Per District policy, the maximum allowable usage for this service is:

- 10 gpm   Peak Flow
- 1 – 3 gpm   Continuous Flow
- 4,400   Maximum Gallons Per Day
- 134,200   Maximum Gallons Per Month

ESTIMATED DOMESTIC USAGE

The estimated hose bibb usage assumes that the caretaker uses a pressure washer at 3 GPM to clean out one storage unit per week at tenant turnover. The actual turnover is expected to be much less than 1 per week, as typically these units lease on a yearly basis. Based on these conservative assumptions, the projected daily water use is 4 GPD, and 124 Gallons per Month.

TABLE 1: SUMMARY OF EXPECTED USE

	Total (GALLONS)	Notes
Locked Hose Bibb	4	Assumes washing 1 bay per week; 3 GPM x 10 minutes, divided by 7
	4	**Total Average Day**
	124	**Total Average Month**

CIVIL RESOURCES
STRONG DESIGN. ENDURING VALUE.

CONCLUSION

The estimated and allowable water usage is compared below:

TABLE 2: ESTIMATED VS ALLOWABLE USEAGE

	Estimated	Allowed
Peak Flow (GPM)	3	10
Maximum Daily Use (Gallons)	4	4,400
Maximum Monthy Use (Gallons)	124	134,200

Overall, the Site has a projected water demand within the allowable parameters for the existing service.

Prepared by: Jim Brzostowicz, P.E.
Reviewed by: Rebekah Janquart, E.I.

Attachments: Excerpt from Resolution 19
                AWWA M22

J:\McCauley Construction 355\355.001.02 Penrose RV Storage\Memos & Reports\Water\Penrose RV Water Use Memo.docx

Jim Brzostowicz, P.E.

Digitally signed by Jim
Brzostowicz, P.E.
DN: C=US,
E=jim@civilresources.com,
OU=Civil Resources,
CN="Jim Brzostowicz, P.E."
Date: 2024.05.20
16:31:39-06'00'

DRAINAGE REPORT

FOR

PENROSE RV & BOAT STORAGE

COUNTY OF FREMONT
STATE OF COLORADO

PREPARED FOR:

McCauley Constructors
605 Innovation Cir.
PO Box 200
Windsor, CO 80550

PREPARED BY:

Civil Resources, LLC
8308 Colorado Blvd.
Suite 200
Firestone, Colorado 80504

PREPARED: FEBRUARY 2024

REVISED: MAY 2024

CIVIL RESOURCES, LLC
ENGINEERS & PLANNERS

Table of Contents

ENGINEER'S CERTIFICATION OF DRAINAGE REPORT

"I hereby certify that this report for the preliminary drainage design of Penrose RV & Boat Storage was prepared by me (or under my direct supervision) in accordance with the provisions of the Urban Drainage Flood Control District Storm Drainage Criteria and supplemental Fremont County requirements for the owners thereof."

Jim Brzostowicz
Registered Professional Engineer
State of Colorado No. 40551

Jim Brzostowicz, P.E.

Digitally signed by Jim
Brzostowicz, P.E.
DN: C=US,
E=jim@civilresources.com,
OU=Civil Resources,
CN="Jim Brzostowicz, P.E."
Date: 2024.05.16
15:48:57-06'00'

1.0   BACKGROUND

1.1   Location

The Penrose RV & Boat Storage project is located at 17225 Highway 115, situated in the northwest one-quarter of Section 28, Township 18 South, Range 68 West of the 6th Principal Meridian, County of Fremont, State of Colorado. The Site includes Lot 2 of the Coyle-Vanegmond lot line adjustment, and is surrounded by Colorado State Highway 115 (SH 115) to the southeast, the Brush Hollow Supply Ditch to the north, and undeveloped land to the west. The lot is currently zoned B – business, per the Fremont County Zoning Resolution. Refer to Figure 1 for a project vicinity map.
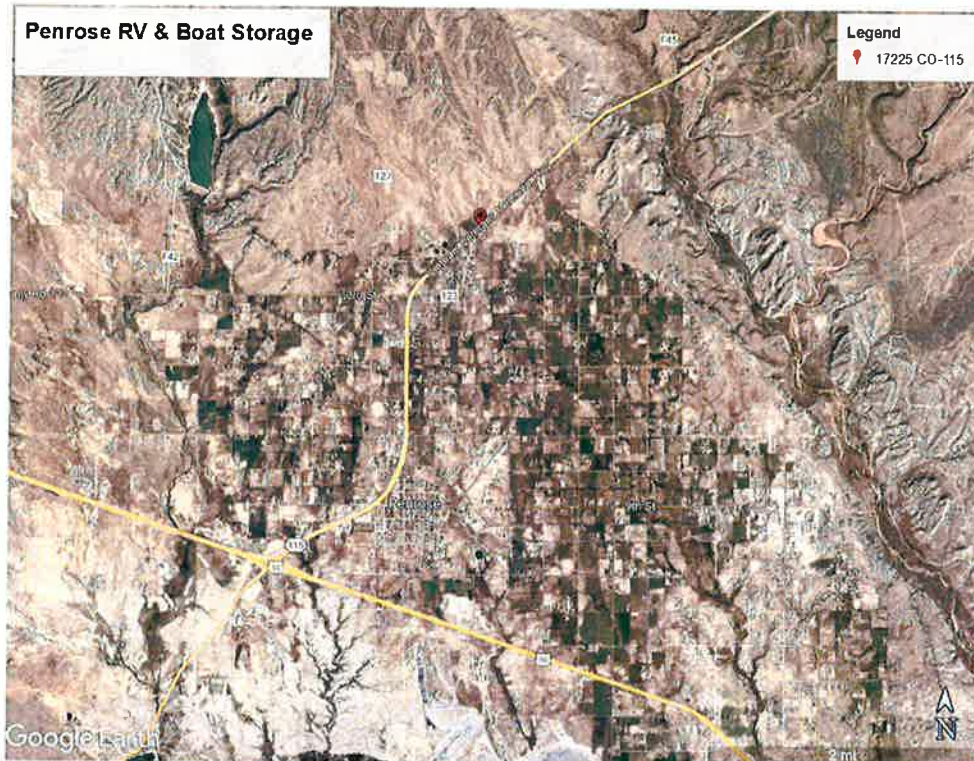
Figure 1: Project Vicinity Map

1.2   Description of Property

The Penrose RV & Boat Storage project proposes to develop the existing Lot 2 of the Coyle-Vanegmond lot line adjustment into approximately 25 storage units for boats and recreational vehicles. The lot contains 1.36 acres of mostly undeveloped land, with an existing garage and shipping container unit. The total drainage area analyzed for the purposes of this drainage report is 2.44 acres, which includes some off-site areas which contribute runoff to the Site.

The Site generally slopes to the southwest with an average grade of 6%. On-site soils can be classified as Hydrologic Soil Group B, per the Natural Resources Conservation Service (NRCS) web soil survey. The Site lies within Zone X, area of minimal hazard, per FEMA National Flood Hazard Layer. Refer to Appendix A for a soils map and FIRMette.

2.0   DRAINAGE BASINS

2.1   Historic Drainage Basins

The existing Site can be divided into three (3) on-site historic drainage basins, and four (4) off-site basins. The existing overall impervious coverage is 10.1%. Refer to Appendix B for historic runoff calculations.

- Basin H-1 is located along the west property line and contains 0.12 acres of undeveloped land. Runoff in this basin generally flows south from the undeveloped area to the existing roadside swale along SH 115, and continues southwest, off-site. The impervious coverage of Basin H-1 is 2.0% and the 100-year historic runoff coefficient is 0.44.

- Basin H-2 contains 1.03 acres of the central portion of the Site, including two existing buildings and landscaped area. Runoff generated in this basin sheet flows south from the central portion of the Site to Basin HOS-2, where it then flows southwest. The impervious coverage of this basin is 8.4% and the 100-year historic runoff coefficient is 0.46.

- Basin H-3 contains the east portion of the Site, and consists of 0.20 acres of undeveloped land. Runoff in this basin sheet flows south to the roadside swale. Runoff is conveyed southwest via an 18-inch corrugated metal pipe culvert, into Basin HOS-3. The impervious coverage of the basin is 2.0% and the 100-year historic runoff coefficient is 0.44.

- Basin HO-1 is located west of Basin H-1 on the west property line, and contains 0.06 acres of undeveloped land. Runoff in this basin sheet flows east into basin H-1. The impervious coverage of this basin is 2.0% and the 100-year historic runoff coefficient is 0.44.

- Basin HOS-1 is located southeast of Basin H-3 between the property line and SH 115. This basin contains 0.41 acres of landscape area and an existing roadside swale. Runoff in the basin sheet flows to the roadside swale and flows southwest via an 18-inch corrugated metal pipe culvert. The impervious coverage of this basin is 15.2% and the 100-year historic runoff coefficient is 0.50.

- Basin HOS-2 is located south of Basin H-2, and contains landscape area and the roadside swale. Runoff sheet flows to the swale, where it channelizes and flows southwest. The impervious coverage of this basin is 15.2% and the 100-year historic runoff coefficient is 0.50.

- Basin HOS-3 is located west of the Site along the property line, and contains 0.12 acres of undeveloped land. Runoff in this basin sheet flows west, off-site. The impervious coverage of this basin is 13.4 cfs, and the 1000-year historic runoff coefficient is 0.44.

2.2   Proposed Drainage Basins

Under developed conditions, the Site can be divided into ten (10) on-site drainage basins and four (4) off-site basins. On-site basins tributary to the detention pond are denoted "S", while off-site basins tributary to the pond are denoted "O". On-site basins bypassing detention are denoted "SO", while off-site basins bypassing detention are denoted "OS". The overall impervious coverage of the developed Site is 31.0%. The Site has not been studied as part of a Master Drainage Report.

- Basin S-1 is located along the north and west property lines. The 0.21-acre basin contains a conveyance swale and landscape area. Runoff in this basin sheet flows to the conveyance swale, where the runoff channelizes and flows west and south to the detention pond. The impervious coverage of this basin is 2.7% and the 100-year developed runoff coefficient is 0.44.

- Basin S-2 is 0.07 acres and contains the roof area of Building B. Runoff developed in this basin will be collected in roof leaders, and surface discharge via downspout to the swale in Basin S-1. The impervious coverage of the basin is 90% and the 100-year developed runoff coefficient is 0.84.

- Basin S-3 is 0.14 acres and contains the roof area of Building A. Runoff in this basin will be collected in roof leaders, and surface discharge via downspout to the swale in Basin S-1. The impervious coverage of this basin is 90% and the 100-year developed runoff coefficient is 0.84.

- Basin S-4 is located in the center of Lot 2, and contains 0.48 acres of the proposed drive aisles. Runoff in this basin sheet flows to a swale centered in the drive aisle, where the runoff channelizes and flows west and south. The swale terminates at the edge of the drive aisle, and runoff enters a second swale, adjacent to the property line, via a riprap rundown. From there, the runoff flows southwest to the detention pond in basin PND. The impervious coverage of the basin is 38.3% and the 100-year developed runoff coefficient is 0.60.

- Basin S-5 is 0.20 acres and contains the roof area of Building C. Runoff generated in this basin will be collected in roof leaders and conveyed to the property line swale in Basin S-4 via an 8" PVC header pipe. The impervious coverage of this basin is 90% and the 100-year developed runoff coefficient is 0.84.

- Basin PND is located in the southwest corner of the Site and contains the 0.08-acre detention pond. Runoff generated in this basin will be captured by the detention pond outlet structure and discharge to the existing roadside swale, via a 12" outfall pipe. The impervious coverage of this basin is 4.1% and the 100-year developed runoff coefficient is 0.45.

- Basin O-1 is an off-site basin, located along the west property line. This basin contains 0.06 acres of undeveloped landscape area, with an impervious coverage of 2.0% and a 100-year developed runoff coefficient of 0.44. Runoff in this basin sheet flows east to the conveyance swale in Basin S-1, and is ultimately detained in the pond.

- Basin OS-1 is an off-site basin, located in the SH 115 right-of-way, between the southeast property line and the highway. The basin contains 0.51 acres of landscaped area and a roadside swale. Runoff in this basin sheet flows to the swale, where it channelizes and flows southwest to an 18-inch culvert under the proposed access drive. The impervious coverage of this basin is 15.6% and the 100-year developed runoff coefficient is 0.50.

- Basin OS-2 is an off-site basin located in the SH 115 right-of-way, between the detention pond and the highway. This basin is 0.40 acres and contains the proposed access drive, the roadside swale, and landscaped area. Runoff generated in this basin sheet flows to the swale, where it channelizes and flows southwest to an existing 18-inch corrugated metal pipe culvert. This basin receives the outflow from the detention pond. The impervious coverage of this basin is 22.8% and the 100-year developed runoff coefficient is 0.53.

- Basin OS-3 is an off-site basin, located at the southwest corner of the Site, which contains 0.11 acres of landscaped area. Runoff in this basin generally sheet flows south to the roadside swale. The impervious coverage of this basin is 14.9% and the 100-year developed runoff coefficient is 0.50.

- Basin SO-1 is an on-site basin, located at the eastern corner of the Site. The basin contains 0.12 acres of landscape area with a swale. Runoff in this basin will sheet flow to the swale, then flow southeast and discharge into basin OS-1 without being detained. The impervious coverage of this basin is 2.0% and the

100-year developed runoff coefficient is 0.44.

- Basin SO-2 is an on-site basin, located at the driveway entrance to the Site. The basin contains 0.02 acres of gravel driveway surface. Runoff in this basin sheet flows south into Basin OS-2, without being detained. The impervious coverage of this basin is 40.0% and the 100-year runoff coefficient is 0.61.

- Basin SO-3 is an on-site basin, located at the southwest corner of the Site, between the property line and detention pond. The basin contains 0.03 acres of landscape area and the detention pond emergency spillway. Runoff in this basin will sheet flow south/southeast and discharge into basin OS-2 without being detained. The impervious coverage of this basin is 8.1% and the 100-year developed runoff coefficient is 0.46.

- Basin SO-4 is an on-site basin, located along the western property line, west of the detention pond. The basin contains 0.02 acres of landscape area. Runoff in this basin will sheet flow south and discharge into basin OS-2 without being detained. The impervious coverage of this basin is 40.0% and the 100-year developed runoff coefficient is 0.44.

3.0   DRAINAGE DESIGN CRITERIA

3.1   Regulations

The proposed drainage design complies with the regulations set forth in the *Subdivision Regulations of Fremont County*, last amended January 2020, as well as the Mile High Flood District's (MHFD) *Urban Storm Drainage Criteria Manual*, version prior to March 2024 updates (USDCM).

3.2   Development Criteria Reference and Constraints

The Subdivision Regulations state that the peak runoff for the developed Site must not exceed the historic peak runoff for the same storm event. Furthermore, stormwater detention facilities shall not release runoff at a rate higher than the historic runoff rate. The proposed development of the Site will increase the overall runoff as a result of increase impervious area. To adhere to the regulations set forth by the Fremont Couty, a detention pond will be used to temporarily store developed runoff and discharge at a rate less than or equal to the historic rate.

3.3   Hydrological Criteria

The hydrology of the Site was determined using the methods described in the *Subdivision Regulations of Fremont County*, last amended January 2020, as well as the Mile High Flood District's (MHFD) *Urban Storm Drainage Criteria Manual*, latest version (USDCM). The following methods were utilized:

- The Rational Method was utilized to estimate the 10- and 100-year peak flowrates as the minor and major storm events, respectively.

- Runoff coefficients for the Site were determined from land usage and hydrologic soil group data as outlined by Tables 6-3 through 6-5 of the USDCM.

- The design point rainfall values used in the Rational Method were obtained from NOAA Atlas 14 Precipitation Frequency Data Server, and are included in Appendix A.

- The Modified FAA Method and Colorado Urban Hydrograph Procedure were utilized to estimate the required 100-year detention volume for the Site.

3.4 Hydraulic Criteria

- The detention pond outlet structure was designed using the MHFD outlet structure workbook. The detention pond will utilize an outlet structure with water quality orifice plate, overflow weir, and outflow pipe with a restrictor plate for 100-year peak flow events or smaller, and an emergency spillway for events exceeding the 100-year storm.

- The Hydraflow Express software was used to model the proposed culverts and roof drain. Please refer to Appendix C for Hydraflow Express output files.

4.0 DRAINAGE FACILITY DESIGN

4.1 General Concept

The proposed stormwater design will generally maintain the historic drainage patterns of the Site. The majority of developed runoff from the Site will be directed southwest toward the proposed detention pond, via sheet flow and conveyance swales. The pond will provide water quality treatment to the developed flow, and will temporarily store developed runoff and discharge from the Site at a rate equal to below the historic runoff. Outflow from the detention pond will discharge to the existing roadside swale adjacent to SH 115.

Off-site basins OS-1, OS-2, and OS-3 will continue to flow off-site, under developed conditions, and on-site basins SO-1 through SO-4 will discharge off-site without being detained. To account for this developed runoff bypassing detention, runoff tributary to the detention pond will be "over-detained". The sum of all developed runoff from basins bypassing detention and the discharge from the detention pond will be equal to or less than the historic runoff for the Site.

4.2 Specific Details

Historically, the Site discharges to the roadside swale along SH 115, and flows southwest along the highway, eventually discharging to Bear Creek. The Site is bounded by the Brush Hollow Supply Ditch on the upstream side, which may intercept upstream runoff during the minor, 10-year storm event. Upstream runoff from the major, 100-year storm will enter and flow through the Site, bypassing detention. The proposed drainage system is designed to maintain the historic drainage patterns and overall discharge point of the Site.

Developed runoff in Basin S-1 will sheet flow to a swale along the north and west property lines. The swale is designed to convey the 100-year developed runoff to the detention pond, via a type VL riprap rundown at design point S-1. The swale in Basin S-1 will also collect runoff generated from the roof areas of Building A in Basin S-3, as well as runoff from off-site, undeveloped Basin O-1. The runoff from the building will be collected in roof leaders, and surface drain, via downspouts, to the swale.

The grading in Basin S-4 is designed to capture developed runoff in a swale, centered in the gravel drive aisle, and direct the runoff south and west, where the swale terminates at a type VL riprap rundown and enters a second swale located between the property line and edge of the gravel drive. The drive aisle swale will also capture developed runoff from the roof of Building B in Basin S-2. Runoff from Basin S-5 is will be captured in roof leaders, and piped to the property line swale in Basin S-4 via an 8" PVC pipe, ultimately discharging to the detention pond

On-site Basins SO-1 through SO-4 will discharge directly off-site, bypassing the detention pond. Due to the existing grades along the property boundary easement, it is impracticable to capture runoff from these basins and direct it to the detention pond.

Off-site Basins OS-1 and OS-2 will be modified slightly from existing conditions to remove the existing access drive and 18" culvert, and relocate the drive and culvert to the southwest. The roadside swale will also be realigned and re-graded to accommodate the new location of the culvert. Basin OS-3 will remain unchanged from historic conditions.

4.3   Stormwater Storage Facilities

The proposed detention pond is designed to treat the WQCV and to detain the 100-year storm event. The pond was sized using the Modified FAA method and the Colorado Urban Hydrograph Procedure (CUHP). The WQCV for the area tributary to the pond was calculated to be 0.020 acre-feet. The 100-year detention volume was calculated to be 0.083 acre-feet per the CUHP, and 0.078 acre-feet per the Modified FAA method; to be conservative, 0.083 acre-feet was used as the minimum 100-year detention volume. The total required detention pond volume is 0.102 acre-feet for the WQCV and 100-year detention volume.

The detention pond will accept a total of 5.60 cfs of developed runoff during the 100-year storm from basins S-1 through S-5, PND, and OS-1. The area tributary to the pond is 1.24 acres, with a composite impervious coverage of 45.0%.

The pond outlet structure will consist of a modified Type C inlet, with a water quality orifice plate, and outfall pipe with flow restrictor. The water quality orifice plate features three (3) 3/8-inch diameter orifices spaced 5.5-inches on-center, and was sized to drain 99% of the WQCV in 43 hours, which satisfies the USDCM minimum of 40 hours. The pond will also drain 97% of the 5-year volume in 63 hours, satisfying the State maximum allowable drain time of 72 hours. Outflow from the pond will discharge to the historic discharge point – the roadside swale along SH 115. The 100-year outflow from the pond will be discharged at a rate of 2.16 cfs.

The pond will have a 5-foot-wide concrete emergency spillway along the southeast side. The invert elevation of the spillway will be 5505.00-feet, 0.01 feet above the 100-year water surface elevation (WSEL) of 5504.99-feet; furthermore, the detention pond will have a top of berm elevation of 5506.00, providing more than 1.00-foot of freeboard above the 100-year WSEL. Table 1 summarizes the stage-storage of the proposed pond. The downstream side of the spillway will be armored with type VL riprap for a length of 5-feet. The spillway was sized to convey the undetained 100-year runoff to the pond, 5.60 cfs. Refer to Appendix C for spillway sizing calculations.

Table 1: Stage-Storage Summary

Stage	Elevation	D Elevation	Area	Incremental Est. Volume	Est. Available Volume		Note
(ft)	(ft)	(ft)	(SF)	(CF)	(CF)	(ac-ft)	
0	5503.00	0.00	0	0	0	0.000	Outlet Structure Invert
0.50	5503.50	0.50	353	88	88	0.002	-
1.00	5504.00	0.50	1,384	434	522	0.012	-
1.23	5504.23	0.23					WQCV WSEL
1.50	5504.50	0.50	2,026	852	1,375	0.032	-
1.99	5504.99	0.49					100-yr WSEL
2.00	5505.00	0.50	2,454	1,120	2,495	0.057	Spillway Invert
2.50	5505.50	0.50	3,013	1,367	3,862	0.089	-
3.00	5506.00	0.50	3,776	1,697	5,559	0.128	Top of Berm

4.4   Runoff Summary

Table 2 illustrates the overall runoff from the developed Site, as compared to historic conditions.

Table 2: Runoff Summary

Point of Discharge	Runoff Existing (CFS)					Runoff Proposed (CFS)					Total Site Discharge Proposed (CFS)				Δ In Discharge from Discharge Point Proposed LESS Existing (CFS)			
	Basin	2-Year	5-Year	10-Year	100-Year	Basin	2-Year	5-Year	10-Year	100-Year	2-Year	5-Year	10-Year	100-Year	2-Year	5-Year	10-Year	100-Year
Detention Pond	H-1	0.00	0.00	0.04	0.44	S-1	0.01	0.01	0.05	0.53	0.012	0.013	0.260	2.16	-0.14	-0.21	-0.43	-3.12
						S-2	0.14	0.18	0.23	0.45								
	H-2	0.14	0.20	0.57	3.87	S-3	0.29	0.38	0.48	0.94								
						S-4	0.28	0.40	0.59	1.79								
	H-2	0.01	0.01	0.06	0.73	S-5	0.42	0.56	0.70	1.38								
	HO-1	0.00	0.00	0.02	0.23	PND	0.01	0.01	0.03	0.29								
						O-1	0.00	0.00	0.02	0.23								
	Total	0.15	0.22	0.69	5.28	Total	1.13	1.54	2.11	5.60								
Direct Off-Site	HOS-1	0.08	0.13	0.26	1.29	OS-1	0.10	0.15	0.30	1.49	0.31	0.47	0.90	4.31	0.12	0.17	0.29	1.19
						OS-2	0.17	0.25	0.43	1.71								
	HOS-2	0.08	0.13	0.27	1.34	OS-3	0.03	0.04	0.09	0.44								
						SO-1	0.00	0.00	0.04	0.43								
						SO-2	0.01	0.02	0.03	0.08								
	HOS-3	0.03	0.04	0.09	0.49	SO-3	0.00	0.01	0.01	0.10								
						SO-4	0.00	0.00	0.01	0.06								
	Total	0.19	0.30	0.61	3.12	Total	0.31	0.47	0.90	4.31								
Overall Site Total	-	0.34	0.52	1.31	8.40	-	1.44	2.01	3.00	9.91	0.32	0.48	1.16	6.47	-0.02	-0.04	-0.15	-1.93

Runoff from basins directly discharging off-site will increase post-development. However, the total runoff discharging from the Site will be reduced by 0.15 cfs for the minor, 10-year storm, and 1.93 cfs for the major, 100-year storm. This satisfies the criteria outlined in the Subdivision Regulations, as the peak flow discharging from the developed Site does not exceed the respective historic storm, for the 10 and 100-year events. Furthermore, the detention pond sufficiently over-detains the 10-year and 100-year runoff to account for undetained developed discharge. The total developed 10-year discharge is 1.16 cfs and 100-year discharge is 6.47 cfs. This is less than the historic 10- and 100-year discharges of 1.31 cfs and 8.40 cfs, respectively.

5.0   CONCLUSIONS

5.1   Compliance with the Town and UDFCD Criteria

This report is in compliance with the provisions outlined in the *Subdivision Regulations of Fremont County*, last amended January 2020, as well as the Mile High Flood District's (MHFD) *Urban Storm Drainage Criteria Manual*, version prior to March 2024 updates (USDCM).

5.2   Drainage Concept

The Penrose RV & Boat Storage project will improve drainage conditions in the proximity of the Site, by utilizing a detention basin. The detention basin will be used to control the discharge of runoff from the Site, by temporarily storing runoff and releasing it at a controlled rate. Runoff from the majority of the developed Site will be captured by the detention pond, and the overall developed runoff from the Site will be reduced from 8.40 cfs to 6.47 cfs, an approximate 23% reduction.

Based on these factors, the proposed project is not anticipated to have an adverse impact on the existing drainage conditions of the Site, nor its immediate vicinity.

6.0 REFERENCES

- *Urban Storm Drainage Criteria Manual, Volumes 1, 2 and 3.* Mile High Flood District. Version prior to March 2024 update.

- *Subdivision Regulations od Fremont County, Colorado.* Fremont County Department of Planning and Zoning. Last amended January 14, 2020.

7.0 LIST OF APPENDICIES

Appendix A – Figures

- Project Vicinity Map
- NRCS HSG Soils Map & Table
- FEMA FIRMette
- NOAA Atlas 14 Point Precipitation Frequency Estimates

Appendix B – Hydrologic Computations

- Developed Runoff Calculations
- Historic Runoff Calculations
- Runoff Summary

Appendix C – Hydraulic Computations

- MHFD Detention Basin Design Workbook
- MHFD Detention Volume by the Modified FAA Method
- Detention Pond Stage-Storage Table
- Hydraflow Storm Sewer Summary Report
- Emergency Spillway Analysis

Appendix D – Drawings

- Historic Drainage Plan
- Drainage Plan

APPENDIX A

Figures

Penrose RV & Boat Storage

Legend
17225 CO-115
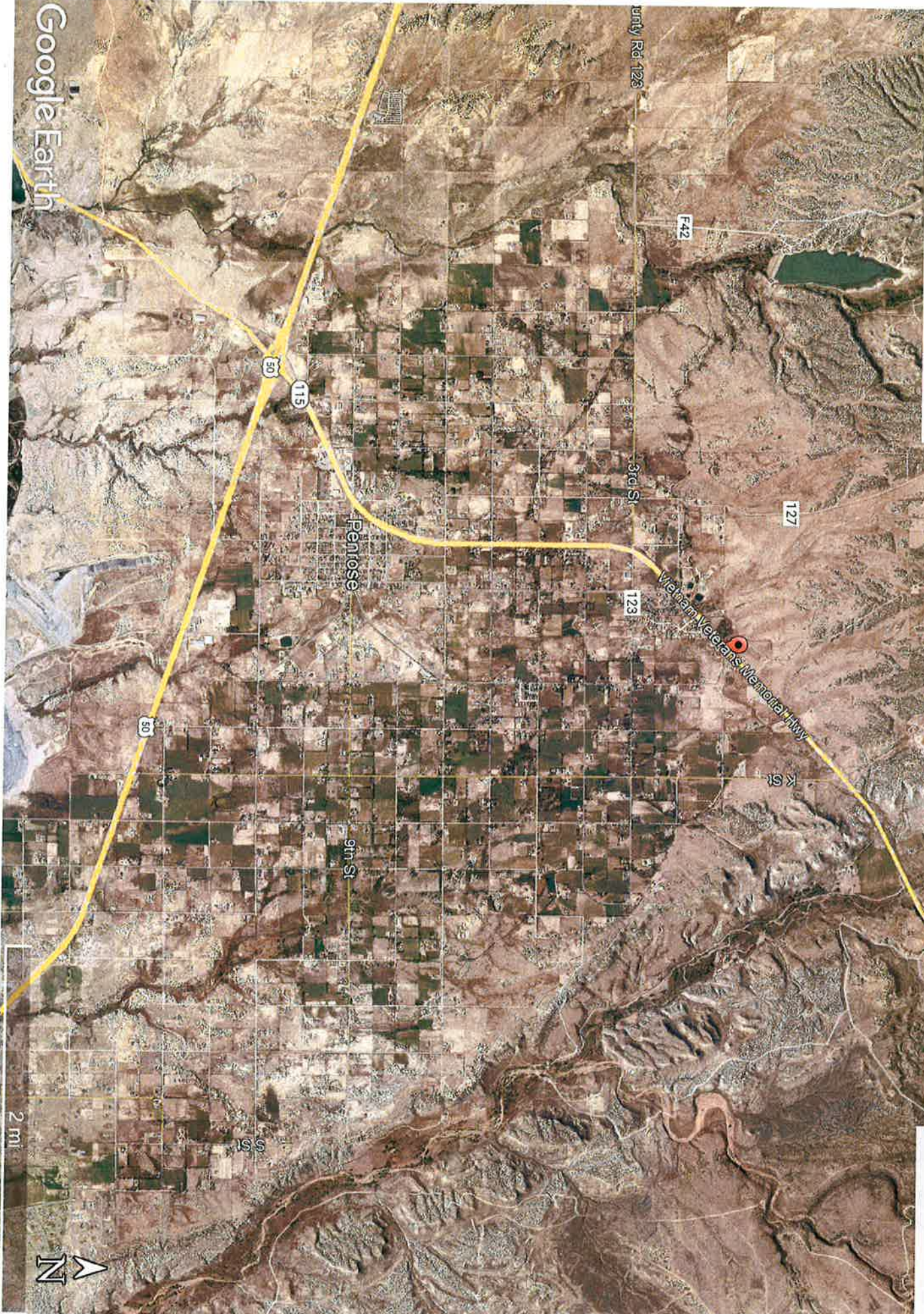
Hydrologic Soil Group—Fremont County Area, Colorado
(17225 SH 115, Penrose, CO)

MAP LEGEND

Area of Interest (AOI)
☐ Area of Interest (AOI)

Soils
Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D

- C
- C/D
- D
- Not rated or not available

Water Features
〰 Streams and Canals

Transportation
+++ Rails
〰 Interstate Highways
〰 US Routes
〰 Major Roads
〰 Local Roads

Background
▢ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Fremont County Area, Colorado
Survey Area Data: Version 20, Sep 7, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 18, 2020—May 21, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
65	Manvel silt loam, 0 to 2 percent slopes	B	1.5	100.0%
Totals for Area of Interest			1.5	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

USDA Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

7/25/2023
Page 3 of 4

Tie-break Rule: Higher

USDA Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

7/25/2023
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National Flood Hazard Layer FIRMette

FEMA

105°19'W 38°27'32"N

T18S R68W S2 FREMONT COUNTY

080067

T18S R68W S2 FREMONT COUNTY

AREA OF MINIMAL FLOOD HAZARD

Zone X

08043C0067.5E
eff. 9/19/2007

T18S R68W S28

105°03'W 38°27'3"N

0   250   500   1,000   1,500   2,000   Feet   1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SPECIAL FLOOD HAZARD AREAS

Without Base Flood Elevation (BFE)
Zone A, V, A99

With BFE or Depth Zone AE, AO, AH, VE, AR

Regulatory Floodway

0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X

Future Conditions 1% Annual Chance Flood Hazard Zone X

Area with Reduced Flood Risk due to Levee. See Notes. Zone X

Area with Flood Risk due to Levee Zone D

OTHER AREAS OF FLOOD HAZARD

OTHER AREAS

NO SCREEN   Area of Minimal Flood Hazard Zone X

Effective LOMRs

Area of Undetermined Flood Hazard Zone D

GENERAL STRUCTURES

Channel, Culvert, or Storm Sewer

Levee, Dike, or Floodwall

20.2 ⊕ 17.5   Cross Sections with 1% Annual Chance
Water Surface Elevation

Coastal Transect

Base Flood Elevation Line (BFE)

Limit of Study

Jurisdiction Boundary

Coastal Transect Baseline

OTHER FEATURES

Profile Baseline

Hydrographic Feature

Digital Data Available

No Digital Data Available

Unmapped

MAP PANELS

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

NOAA Atlas 14, Volume 8, Version 2
Location name: Penrose, Colorado, USA*
Latitude: 38.4543°, Longitude: -105.014°
Elevation: 5514 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.223 (0.172-0.288)	0.267 (0.206-0.346)	0.349 (0.268-0.453)	0.425 (0.325-0.555)	0.543 (0.408-0.756)	0.644 (0.471-0.908)	0.754 (0.533-1.10)	0.874 (0.593-1.31)	1.05 (0.684-1.62)	1.19 (0.753-1.86)
10-min	0.326 (0.253-0.422)	0.391 (0.302-0.507)	0.510 (0.393-0.663)	0.622 (0.477-0.813)	0.795 (0.598-1.11)	0.943 (0.689-1.33)	1.10 (0.780-1.60)	1.28 (0.869-1.92)	1.53 (1.00-2.38)	1.74 (1.10-2.72)
15-min	0.398 (0.308-0.515)	0.477 (0.369-0.618)	0.623 (0.479-0.809)	0.759 (0.581-0.992)	0.969 (0.729-1.35)	1.15 (0.841-1.62)	1.35 (0.951-1.96)	1.56 (1.06-2.34)	1.87 (1.22-2.90)	2.12 (1.34-3.32)
30-min	0.565 (0.437-0.731)	0.676 (0.522-0.875)	0.880 (0.678-1.14)	1.07 (0.821-1.40)	1.37 (1.03-1.91)	1.62 (1.19-2.29)	1.90 (1.34-2.76)	2.21 (1.50-3.32)	2.65 (1.73-4.10)	3.01 (1.90-4.70)
60-min	0.704 (0.545-0.911)	0.831 (0.642-1.08)	1.08 (0.829-1.40)	1.32 (1.01-1.72)	1.70 (1.28-2.38)	2.03 (1.49-2.88)	2.40 (1.70-3.51)	2.82 (1.92-4.25)	3.43 (2.24-5.33)	3.93 (2.49-6.14)
2-hr	0.844 (0.658-1.08)	0.986 (0.769-1.27)	1.27 (0.988-1.64)	1.56 (1.20-2.02)	2.02 (1.55-2.83)	2.44 (1.81-3.44)	2.91 (2.08-4.21)	3.43 (2.36-5.13)	4.20 (2.78-6.48)	4.85 (3.10-7.50)
3-hr	0.909 (0.713-1.16)	1.05 (0.822-1.34)	1.34 (1.05-1.72)	1.65 (1.28-2.12)	2.16 (1.67-3.01)	2.62 (1.96-3.69)	3.15 (2.27-4.55)	3.75 (2.60-5.58)	4.63 (3.09-7.10)	5.38 (3.46-8.26)
6-hr	1.04 (0.825-1.32)	1.19 (0.937-1.50)	1.50 (1.18-1.90)	1.83 (1.44-2.34)	2.41 (1.88-3.34)	2.94 (2.22-4.10)	3.54 (2.59-5.08)	4.24 (2.97-6.26)	5.28 (3.56-8.02)	6.15 (4.00-9.35)
12-hr	1.22 (0.975-1.53)	1.38 (1.10-1.73)	1.73 (1.38-2.17)	2.10 (1.66-2.65)	2.72 (2.14-3.73)	3.29 (2.51-4.54)	3.95 (2.91-5.59)	4.69 (3.32-6.85)	5.81 (3.95-8.72)	6.75 (4.43-10.1)
24-hr	1.42 (1.14-1.76)	1.63 (1.31-2.02)	2.04 (1.64-2.54)	2.46 (1.96-3.08)	3.15 (2.49-4.23)	3.76 (2.88-5.10)	4.45 (3.30-6.20)	5.23 (3.73-7.51)	6.37 (4.38-9.43)	7.33 (4.86-10.9)
2-day	1.63 (1.32-2.00)	1.90 (1.54-2.33)	2.41 (1.95-2.97)	2.91 (2.34-3.60)	3.69 (2.93-4.87)	4.37 (3.37-5.83)	5.12 (3.82-7.03)	5.95 (4.28-8.42)	7.16 (4.96-10.4)	8.16 (5.47-12.0)
3-day	1.77 (1.45-2.16)	2.07 (1.69-2.52)	2.63 (2.14-3.22)	3.17 (2.56-3.90)	4.02 (3.21-5.27)	4.76 (3.70-6.31)	5.57 (4.19-7.60)	6.47 (4.68-9.10)	7.78 (5.42-11.3)	8.86 (5.98-12.9)
4-day	1.90 (1.55-2.30)	2.21 (1.81-2.69)	2.81 (2.29-3.42)	3.38 (2.74-4.14)	4.28 (3.42-5.58)	5.05 (3.94-6.67)	5.91 (4.46-8.02)	6.86 (4.98-9.59)	8.23 (5.76-11.9)	9.36 (6.35-13.6)
7-day	2.22 (1.84-2.68)	2.59 (2.13-3.12)	3.26 (2.68-3.94)	3.88 (3.17-4.72)	4.85 (3.90-6.25)	5.68 (4.45-7.41)	6.58 (5.00-8.83)	7.58 (5.54-10.5)	9.00 (6.35-12.8)	10.2 (6.96-14.6)
10-day	2.50 (2.07-2.99)	2.90 (2.40-3.47)	3.62 (2.99-4.35)	4.28 (3.52-5.18)	5.29 (4.27-6.75)	6.14 (4.83-7.94)	7.06 (5.38-9.39)	8.06 (5.92-11.0)	9.48 (6.72-13.4)	10.6 (7.32-15.2)
20-day	3.22 (2.70-3.82)	3.72 (3.11-4.41)	4.57 (3.81-5.44)	5.32 (4.41-6.37)	6.42 (5.20-8.03)	7.32 (5.79-9.29)	8.26 (6.34-10.8)	9.25 (6.85-12.5)	10.6 (7.60-14.8)	11.7 (8.17-16.6)
30-day	3.81 (3.21-4.49)	4.39 (3.69-5.18)	5.37 (4.50-6.35)	6.20 (5.17-7.38)	7.38 (5.99-9.13)	8.32 (6.61-10.5)	9.28 (7.16-12.0)	10.3 (7.64-13.7)	11.6 (8.36-16.0)	12.7 (8.90-17.8)
45-day	4.57 (3.86-5.35)	5.27 (4.46-6.18)	6.42 (5.41-7.55)	7.37 (6.18-8.71)	8.68 (7.06-10.6)	9.68 (7.72-12.0)	10.7 (8.27-13.7)	11.7 (8.73-15.4)	13.0 (9.40-17.8)	14.1 (9.91-19.5)
60-day	5.22 (4.43-6.09)	6.04 (5.12-7.05)	7.36 (6.22-8.61)	8.42 (7.09-9.91)	9.85 (8.02-11.9)	10.9 (8.73-13.5)	12.0 (9.29-15.2)	13.0 (9.73-17.0)	14.3 (10.4-19.4)	15.3 (10.9-21.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
Please refer to NOAA Atlas 14 document for more information.

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PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 38.4543°, Longitude: -105.0140°

NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Tue Jul 25 22:04:26 2023
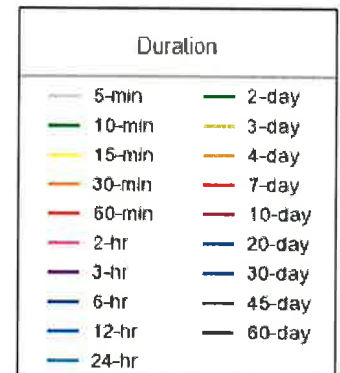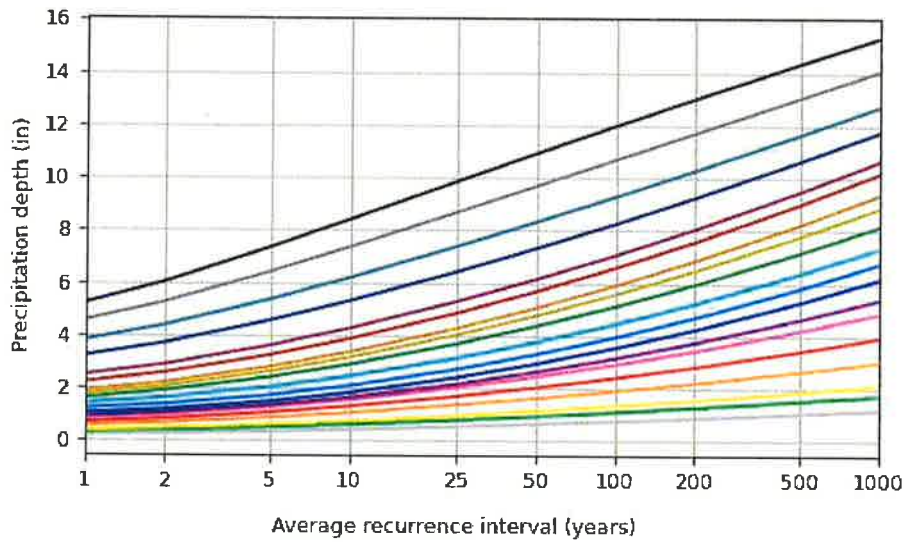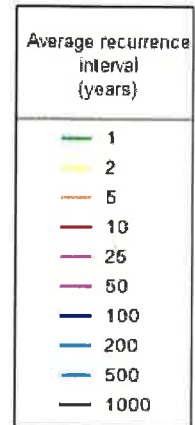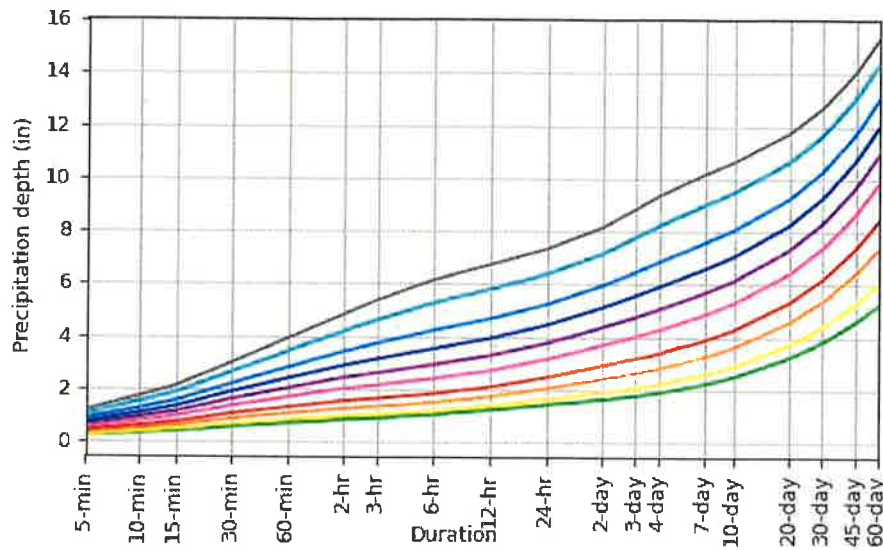
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Maps & aerials

Small scale terrain
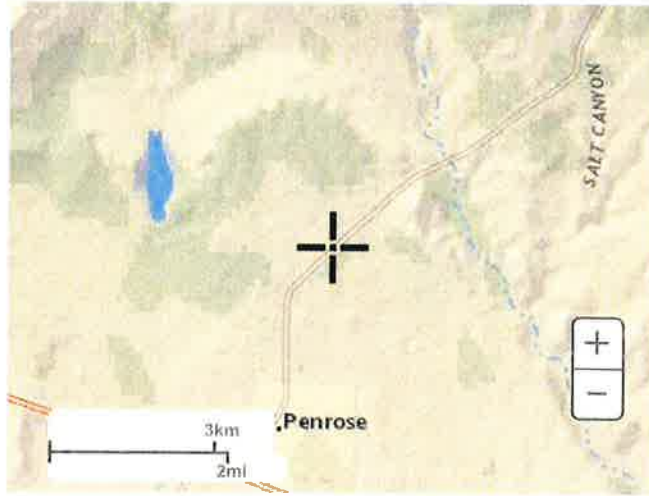
Large scale terrain

Large scale map

Large scale aerial
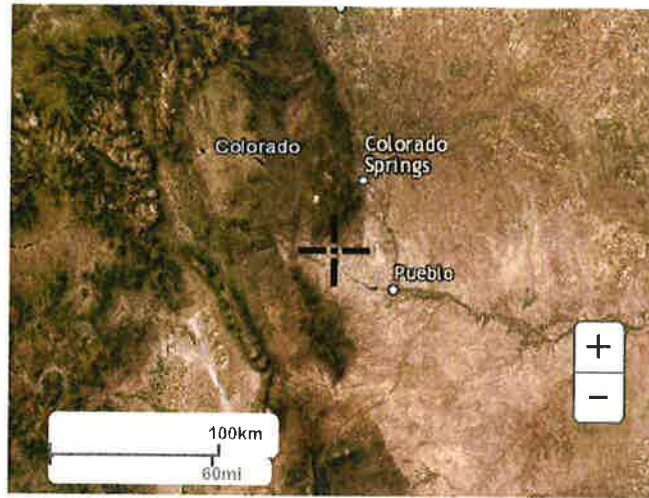
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Disclaimer

APPENDIX B

Hydrologic Computations

Table 1
PENROSE RV & BOAT STORAGE
DEVELOPED DRAINAGE
WEIGHTED PERCENT IMPERVIOUSNESS AND RUNOFF COEFFICIENT "C"

Land Use	Imperviousness (%)
Roof	90
Pavement	100
Gravel	40
Landscape/Open	2
Historic	2

NRCS Hydrologic Soil Group	B

Sub-Basin I.D.	TOTAL		Area										Weighted Imperviousness (%)	Runoff Coefficient "C"			
			Roof		Pavement		Gravel		LC/Open		Historic			2-Year	5-Year	10-Year	100-Year
	(sf)	(ac)	(sf)	(ac)	(sf)	(ac)	(sf)	(ac)	(sf)	(ac)	(sf)	(ac)	(%)	-	-	-	-
OS-1	22,233	0.51	0	0.00	3,079	0.07	0	0.00	19,153	0.44	0	0.00	15.6	0.09	0.11	0.18	0.50
OS-2	17,289	0.40	0	0.00	3,164	0.07	1,302	0.03	12,823	0.29	0	0.00	22.8	0.15	0.17	0.24	0.53
OS-3	4,704	0.11	0	0.00	537	0.01	209	0.00	3,958	0.09	0	0.00	14.9	0.09	0.11	0.18	0.50
SO-1	5,276	0.12	0	0.00	0	0.00	0	0.00	5,276	0.12	0	0.00	2.0	0.01	0.01	0.07	0.44
SO-2	726	0.02	0	0.00	0	0.00	726	0.02	0	0.00	0	0.00	40.0	0.29	0.32	0.38	0.61
SO-3	1,117	0.03	0	0.00	0	0.00	52	0.00	45	0.00	1,020	0.02	0	0.00	8.1	0.05	0.05	0.12	0.46
SO-4	730	0.02	0	0.00	0	0.00	0	0.00	730	0.02	0	0.00	2.0	0.01	0.01	0.07	0.44
OFF-SITE TOTAL	52,076	1.20	0	0.00	6,833	0.16	2,282	0.05	42,961	0.99	0	0.00	16.5	0.10	0.12	0.19	0.51
S-1	9,328	0.21	0	0.00	0	0.00	161	0.00	9,167	0.21	0	0.00	2.7	0.01	0.01	0.08	0.44
S-2	2,850	0.07	2,850	0.07	0	0.00	0	0.00	0	0.00	0	0.00	90.0	0.74	0.76	0.78	0.84
S-3	6,000	0.14	6,000	0.14	0	0.00	0	0.00	0	0.00	0	0.00	90.0	0.74	0.76	0.78	0.84
S-4	20,866	0.48	0	0.00	1,920	0.04	14,993	0.34	3,952	0.09	0	0.00	38.3	0.27	0.30	0.36	0.60
S-5	8,800	0.20	8,800	0.20	0	0.00	0	0.00	0	0.00	0	0.00	90.0	0.74	0.76	0.78	0.84
PND	3,491	0.08	0	0.00	0	0.00	196	0.00	3,294	0.08	0	0.00	4.1	0.02	0.02	0.09	0.45
O-1	2,754	0.06	0	0.00	0	0.00	0	0.00	2,754	0.06	0	0.00	2.0	0.01	0.01	0.07	0.44
POND TOTAL	54,089	1.24	17,650	0.41	1,920	0.04	15,350	0.35	19,168	0.44	0	0.00	45.0	0.33	0.36	0.42	0.64
Total	106,165	2.44	17,650	0.41	8,753	0.20	17,632	0.40	62,129	1.43	0	0.00	31.0	0.21	0.24	0.31	0.57

¹Runoff Coefficient "C" Values are from Table 6-5 in the USDCM.

CIVIL RESOURCES

Table 2
PENROSE RV & BOAT STORAGE
DEVELOPED DRAINAGE
DEVELOPED T_c

Type of Land Surface	NRCS Conveyance Factor, K
Heavy meadow	2.5
Tillage/Field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

NRCS Hydrologic Soil Group	B

Sub-Basin I.D.	Total Area (ac)	Overland Sheet Flow Length (ft)	Slope (%)	Shallow Concentrated Flow Length (ft)	Slope (%)	K	Imp (%)	Cs	Eqn 6-3 Ti [1] (min)	Eqn 6-4 Tt [2] (min)	Eqn 6-2 Tc [3] (min)	Eqn 6-5 Tc [4] (min)	Final Tc (min)
OS-1	0.51	125	6.4%	152	2.4%	7	15.6	0.11	10.8	2.3	13.1	24.8	13.1
OS-2	0.40	74	7.3%	162	0.0%	7	22.8	0.17	7.5	0.0	7.5	0.0	5.0
OS-3	0.11	108	4.4%	0	0.0%	7	14.9	0.11	11.5	0.0	11.5	0.0	5.0
SO-1	0.12	44	2.7%	32	0.0%	15	2.0	0.01	9.4	0.0	9.4	0.0	5.0
SO-2	0.02	46	5.1%	0	0.0%	20	40.0	0.32	5.6	0.0	5.6	0.0	5.0
SO-3	0.03	21	11.1%	0	0.0%	7	8.1	0.05	3.9	0.0	3.9	0.0	5.0
SO-4	0.02	20	35.8%	0	0.0%	7	2.0	0.01	2.7	0.0	2.7	0.0	5.0
S-1	0.21	37	1.0%	318	2.8%	15	2.7	0.01	11.8	2.1	13.9	28.9	13.9
S-2	0.07	40	0.0%	0	0.0%	20	90.0	0.76	14.1	0.0	14.1	0.0	5.0
S-3	0.14	50	0.0%	0	0.0%	20	90.0	0.76	15.8	0.0	15.8	0.0	5.0
S-4	0.48	64	1.9%	343	2.2%	20	38.3	0.30	9.3	1.9	11.2	22.2	11.2
S-5	0.20	50	0.0%	0	0.0%	20	90.0	0.76	16.0	0.0	16.0	0.0	5.0
PND	0.08	34	12.3%	48	1.8%	15	4.1	0.02	5.0	0.4	5.4	25.9	5.4
O-1	0.06	86	5.0%	0	0.0%	7	2.0	0.01	10.7	0.0	10.7	0.0	5.0

[1] $Ti = 0.395*(1.1-C_5)*L^{0.5}/S^{0.33}$ (Eq. 6-3)

[2] $Tt = L/(60*K*(So^{0.50}))$ (Eq. 6-4)

[3] $T_c = T_i + T_t$ (Eq. 6-2)

[4] $Tt = (26-17i)+(Lt/(60*(14i + 9)*(So^{0.5})))$ (Eq. 6-5)

CIVIL RESOURCES

Table 3
PENROSE RV & BOAT STORAGE
DEVELOPED DRAINAGE
DEVELOPED PEAK FLOWS

P_1	2-year	5-year	10-year	100-year
	0.83	1.08	1.32	2.40

NRCS Hydrologic Soil Group	B

Sub-Basin I.D.	Total Area (ac)	Final T_c (min)	Weighted Imper. (%)	[2]Runoff Coefficient "C"				[3]Rainfall Intensity "I"				[4]Runoff			
				2-Year	5-Year	10-Year	100-Year	2-Year (in/hour)	5-Year (in/hour)	10-Year (in/hour)	100-Year (in/hour)	2-Year (cfs)	5-Year (cfs)	10-Year (cfs)	100-Year (cfs)
OS-1	0.51	13.1	15.6	0.09	0.11	0.18	0.50	2.01	2.61	3.19	5.80	0.10	0.15	0.30	1.49
OS-2	0.40	5.0	22.8	0.15	0.17	0.24	0.53	2.82	3.66	4.48	8.14	0.17	0.25	0.43	1.71
OS-3	0.11	5.0	14.9	0.09	0.11	0.18	0.50	2.82	3.66	4.48	8.14	0.03	0.04	0.09	0.44
SO-1	0.12	5.0	2.0	0.01	0.01	0.07	0.44	2.82	3.66	4.48	8.14	0.00	0.00	0.04	0.43
SO-2	0.02	5.0	40.0	0.29	0.32	0.38	0.61	2.82	3.66	4.48	8.14	0.01	0.02	0.03	0.08
SO-3	0.03	5.0	8.1	0.05	0.05	0.12	0.46	2.82	3.66	4.48	8.14	0.00	0.01	0.01	0.10
SO-4	0.02	5.0	2.0	0.01	0.01	0.07	0.44	2.82	3.66	4.48	8.14	0.00	0.00	0.01	0.06
OFF-SITE TOTAL	1.20	-	16.5	0.10	0.12	0.19	0.51	-	-	-	-	0.31	0.47	0.90	4.31
S-1	0.21	13.9	2.7	0.01	0.01	0.08	0.44	1.95	2.54	3.10	5.64	0.01	0.01	0.05	0.53
S-2	0.07	5.0	90.0	0.74	0.76	0.78	0.84	2.82	3.66	4.48	8.14	0.14	0.18	0.23	0.45
S-3	0.14	5.0	90.0	0.74	0.76	0.78	0.84	2.82	3.66	4.48	8.14	0.29	0.38	0.48	0.94
S-4	0.48	11.2	38.3	0.27	0.30	0.36	0.60	2.15	2.79	3.41	6.20	0.28	0.40	0.59	1.79
S-5	0.20	5.0	90.0	0.74	0.76	0.78	0.84	2.82	3.66	4.48	8.14	0.42	0.56	0.70	1.38
PND	0.08	5.4	4.1	0.02	0.02	0.09	0.45	2.76	3.59	4.39	7.98	0.01	0.01	0.03	0.29
O-1	0.06	5.0	2.0	0.01	0.01	0.07	0.44	2.82	3.66	4.48	8.14	0.00	0.00	0.02	0.23
POND TOTAL	1.24	-	45.0	0.33	0.36	0.42	0.64	-	-	-	-	1.13	1.54	2.11	5.60
Total	2.44	-	31.0	0.21	0.24	0.31	0.57	-	-	-	-	1.44	2.01	3.00	9.91

[1] P_1 for the 2-year, 5-year, 10-year and 100-year storms were taken from NOAA Atlas 14 (Vol. 8, Ver. 2) Point Precipitation Frequency Estimates

[2] Table 6-5 (USDCM) along with the weighted imperviousness for each basin was used to find the composite "C" runoff coefficient.

[3] I Taken from Final Report OR I = $(28.5*P_1)/(10+T_c)^{0.786}$ (Eq. 5-3)

[4] Q = CIA

CIVIL RESOURCES

Table 4
PENROSE RV & BOAT STORAGE
EXISTING DRAINAGE
WEIGHTED PERCENT IMPERVIOUSNESS AND RUNOFF COEFFICIENT "C"

Land Use	Imperviousness (%)
Roof	90
Pavement	100
Gravel	40
Landscape/Open	2
Historic	2

NRCS Hydrologic Soil Group	B

Sub-Basin I.D.	TOTAL		Area								Weighted Imperviousness (%)	¹Runoff Coefficient "c"			
			Roof		Pavement		Gravel		LC/Open		Historic		2-Year	5-Year	10-Year	100-Year
	(sf)	(ac)	(sf)	(ac)	(sf)	(ac)	(sf)	(ac)	(sf)	(ac)	(sf)	(ac)					
H-1	5,406	0.12	0	0.00	0	0.00	0	0.00	0	0.00	5,406	0.12	2.0	0.01	0.01	0.07	0.44
H-2	44,867	1.03	1,233	0.03	0	0.00	4,666	0.11	0	0.00	38,968	0.89	8.4	0.05	0.05	0.12	0.46
H-3	8,910	0.20	0	0.00	0	0.00	0	0.00	0	0.00	8,910	0.20	2.0	0.01	0.01	0.07	0.44
HOS-1	17,702	0.41	0	0.00	2,323	0.05	159	0.00	0	0.00	15,220	0.35	15.2	0.09	0.11	0.18	0.50
HOS-2	21,201	0.49	0	0.00	2,597	0.06	681	0.02	0	0.00	17,924	0.41	15.2	0.09	0.11	0.18	0.50
HOS-3	5,326	0.12	0	0.00	537	0.01	209	0.00	0	0.00	4,580	0.11	13.4	0.08	0.09	0.16	0.49
HO-1	2,748	0.06	0	0.00	0	0.00	0	0.00	0	0.00	2,748	0.06	2.0	0.01	0.01	0.07	0.44
Total	106,159	2.44	1,233	0.03	5,457	0.13	5,715	0.13	0	0.00	93,755	2.15	10.1	0.06	0.07	0.14	0.47

¹Runoff Coefficient "C" Values are from Table 6-5 in the USDCM.

CIVIL RESOURCES

Table 5
PENROSE RV & BOAT STORAGE
EXISTING DRAINAGE
EXISTING T$_c$

Type of Land Surface	NRCS Conveyance Factor, K
Heavy meadow	2.5
Tillage/Field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

NRCS Hydrologic Soil Group	B

Sub-Basin I.D.	Total Area (ac)	Overland Sheet Flow		Shallow Concentrated Flow			Imp (%)	C$_s$	Eqn 6-3 T$_i^1$ (min)	Eqn 6-4 T$_t^2$ (min)	Eqn 6-2 T$_c^3$ (min)	Eqn 6-5 T$_c^4$ (min)	Final T$_c$ (min)
		Length (ft)	Slope (%)	Length (ft)	Slope (%)	K							
H-1	0.12	258	3.5%	0	0.0%	7	2.0	0.01	20.9	0.0	20.9	0.0	5.0
H-2	1.03	221	2.9%	0	0.0%	7	8.4	0.05	19.7	0.0	19.7	0.0	5.0
H-3	0.20	89	4.1%	0	0.0%	7	2.0	0.01	11.6	0.0	11.6	0.0	5.0
HOS-1	0.41	85	7.4%	145	3.0%	7	15.2	0.11	8.5	2.0	10.5	24.7	10.5
HOS-2	0.49	95	3.3%	184	2.3%	7	15.2	0.11	11.8	2.9	14.7	25.2	14.7
HOS-3	0.12	108	4.3%	0	0.0%	7	13.4	0.09	11.6	0.0	11.6	0.0	5.0
HO-1	0.06	76	4.8%	0	0.0%	7	2.0	0.01	10.2	0.0	10.2	0.0	5.0

[1] $T_i = 0.395*(1.1-C_s)*L^{0.5}/S^{0.33}$ (Eq. 6-3)

[2] $T_t = L/(60*K*(S_o^{0.50}))$ (Eq. 6-4)

[3] $T_c = T_i + T_t$ (Eq. 6-2)

[4] $T_t = (26-17i)+(L_t/(60*(14i + 9)*(S_o^{0.5})))$ (Eq. 6-5)

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CIVIL RESOURCES

Table 6
PENROSE RV & BOAT STORAGE
EXISTING DRAINAGE
EXISTING PEAK FLOWS

[1]P₁	2-year	5-year	10-year	100-year
	0.83	1.08	1.32	2.40

NRCS Hydrologic Soil Group	B

Sub-Basin I.D.	Total Area (ac)	Final T_c (min)	Weighted Imper. (%)	[2]Runoff Coefficient "C"				[3]Rainfall Intensity "I"				[4]Runoff			
				2-Year	5-Year	10-Year	100-Year	2-Year (in/hour)	5-Year (in/hour)	10-Year (in/hour)	100-Year (in/hour)	2-Year (cfs)	5-Year (cfs)	10-Year (cfs)	100-Year (cfs)
H-1	0.12	5.0	2.0	0.01	0.01	0.07	0.44	2.82	3.66	4.48	8.14	0.00	0.00	0.04	0.44
H-2	1.03	5.0	8.4	0.05	0.05	0.12	0.46	2.82	3.66	4.48	8.14	0.14	0.20	0.57	3.87
H-3	0.20	5.0	2.0	0.01	0.01	0.07	0.44	2.82	3.66	4.48	8.14	0.01	0.01	0.06	0.73
HOS-1	0.41	10.5	15.2	0.09	0.11	0.18	0.50	2.20	2.86	3.50	6.36	0.08	0.13	0.26	1.29
HOS-2	0.49	14.7	15.2	0.09	0.11	0.18	0.50	1.91	2.48	3.03	5.51	0.08	0.13	0.27	1.34
HOS-3	0.12	5.0	13.4	0.08	0.09	0.16	0.49	2.82	3.66	4.48	8.14	0.03	0.04	0.09	0.49
HO-1	0.06	5.0	2.0	0.01	0.01	0.07	0.44	2.82	3.66	4.48	8.14	0.00	0.00	0.02	0.23
Total	2.44	-	10.1	0.06	0.07	0.14	0.47	-	-	-	-	0.34	0.52	1.31	8.40

[1] P_1 for the 2-year, 5-year, 10-year and 100-year storms were taken from NOAA Atlas 14 (Vol. 8, Ver. 2) Point Precipitation Frequency Estimates

[2] Table 6-5 (USDCM) along with the weighted imperviousness for each basin was used to find the composite "C" runoff coefficient.

[3] I Taken from Final Report OR I = $(28.5 \cdot P_1)/(10+T_c)^{0.786}$ (Eq. 5-3)

[4] Q = CIA

CIVIL RESOURCES

Table 7
PENROSE RV & BOAT STORAGE
SITE
RUNOFF COMPARISON

| Point of Discharge	Runoff Existing (CFS)					Runoff Proposed (CFS)					Total Site Discharge Proposed (CFS)				Δ in Discharge from Discharge Point Proposed LESS Existing (CFS)			
	Basin	2-Year	5-Year	10-Year	100-Year	Basin	2-Year	5-Year	10-Year	100-Year	2-Year	5-Year	10-Year	100-Year	2-Year	5-Year	10-Year	100-Year
H-1		0.00	0.00	0.04	0.44	S-1	0.01	0.01	0.05	0.53								
H-2 (Detention Pond)		0.14	0.20	0.57	3.87	S-2	0.14	0.18	0.23	0.45								
H-2		0.01	0.01	0.06	0.73	S-3	0.29	0.38	0.48	0.94								
HO-1		0.00	0.00	0.02	0.23	S-4	0.28	0.40	0.59	1.79								
						S-5	0.42	0.56	0.70	1.38								
						PND	0.00	0.00	0.02	0.23								
						O-1	0.01	0.01	0.03	0.29								
Total		0.15	0.22	0.69	5.28	Total	1.13	1.54	2.11	5.60	0.012	0.013	0.260	2.16	-0.14	-0.21	-0.43	-3.12
HOS-1 (Direct Off-Site)		0.08	0.13	0.26	1.29	OS-3	0.03	0.04	0.09	0.44								
HOS-2		0.08	0.13	0.27	1.34	OS-2	0.17	0.25	0.43	1.71								
HOS-3		0.03	0.04	0.09	0.49	OS-1	0.10	0.15	0.30	1.49								
						SO-1	0.00	0.00	0.04	0.43								
						SO-2	0.01	0.02	0.03	0.08								
						SO-3	0.00	0.01	0.01	0.10								
						SO-4	0.00	0.00	0.01	0.06								
Total		0.19	0.30	0.61	3.12	Total	0.31	0.47	0.90	4.31	0.31	0.47	0.90	4.31	0.12	0.17	0.29	1.19
Overall Site Total		0.34	0.52	1.31	8.40		1.44	2.01	3.00	9.91	0.32	0.48	1.16	6.47	-0.02	-0.04	-0.15	-1.93

CIVIL RESOURCES

APPENDIX C

Hydraulic Computations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Penrose RV & Boat Storage

Basin ID: PND

Example Zone Configuration (Retention Pond)
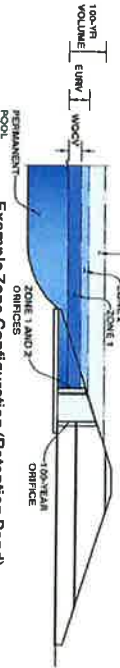
Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	1.24	acres
Watershed Length =	450	ft
Watershed Length to Centroid =	240	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	45.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.020	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.059	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 0.83 in.) =	0.033	acre-feet	0.83 inches
5-yr Runoff Volume (P1 = 1.08 in.) =	0.046	acre-feet	1.08 inches
10-yr Runoff Volume (P1 = 1.32 in.) =	0.064	acre-feet	1.32 inches
25-yr Runoff Volume (P1 = 1.7 in.) =	0.106	acre-feet	1.70 inches
50-yr Runoff Volume (P1 = 2.03 in.) =	0.138	acre-feet	2.03 inches
100-yr Runoff Volume (P1 = 2.4 in.) =	0.180	acre-feet	2.40 inches
500-yr Runoff Volume (P1 = 3.43 in.) =	0.287	acre-feet	3.43 inches
Approximate 2-yr Detention Volume =	0.031	acre-feet	
Approximate 5-yr Detention Volume =	0.044	acre-feet	
Approximate 10-yr Detention Volume =	0.062	acre-feet	
Approximate 25-yr Detention Volume =	0.077	acre-feet	
Approximate 50-yr Detention Volume =	0.086	acre-feet	
Approximate 100-yr Detention Volume =	0.102	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.020	acre-feet
Zone 2 Volume (100-year - Zone 1) =	0.083	acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.102	acre-feet

Stage-Storage Table

Depth Increment = [ ] ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft²)	Optional Override Area (ft²)	Area (acre)	Volume (ft³)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	0	0.000	0.000	
5503.5	--	0.50	--	--	--	353	0.008	88	0.002
5504	--	1.00	--	--	--	1,384	0.032	522	0.012
5504.5	--	1.50	--	--	--	2,026	0.047	1,375	0.032
5505	--	2.00	--	--	--	2,454	0.056	2,495	0.057
5505.5	--	2.50	--	--	--	3,013	0.069	3,862	0.089
5506	--	3.00	--	--	--	3,776	0.087	5,559	0.128

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: Penrose RV & Boat Storage
Basin ID: PND

Example Zone Configuration (Retention Pond)
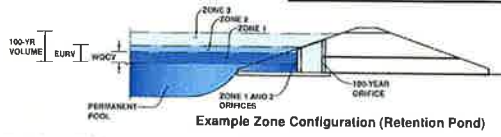
	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.23	0.020	Orifice Plate
Zone 2 (100-year)	2.70	0.083	Weir&Pipe (Restrict)
Zone 3			
Total (all zones)	0.102		

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

			Calculated Parameters for Underdrain	
Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)	Underdrain Orifice Area =	N/A ft²
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

			Calculated Parameters for Plate	
Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	8.333E-04 ft²
Depth at top of Zone using Orifice Plate =	1.23	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A feet
Orifice Plate: Orifice Vertical Spacing =	5.50	inches	Elliptical Slot Centroid =	N/A feet
Orifice Plate: Orifice Area per Row =	0.12	sq. inches (diameter = 3/8 inch)	Elliptical Slot Area =	N/A ft²

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.50	1.00					
Orifice Area (sq. inches)	0.12	0.12	0.12					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected		Calculated Parameters for Vertical Orifice	
				Not Selected	Not Selected
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	ft²
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	feet
Vertical Orifice Diameter =			inches		

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Zone 2 Weir	Not Selected			Calculated Parameters for Overflow Weir	
					Zone 2 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	1.80		ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	1.80	feet
Overflow Weir Front Edge Length =	4.00		feet	Overflow Weir Slope Length =	4.00	feet
Overflow Weir Grate Slope =	0.00		H:V	Grate Open Area / 100-yr Orifice Area =		
Horiz. Length of Weir Sides =	4.00		feet	Overflow Grate Open Area w/o Debris =	11.14	ft²
Overflow Grate Type =	Type C Grate			Overflow Grate Open Area w/ Debris =	5.57	ft²
Debris Clogging % =	50%		%			

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 2 Restrictor	Not Selected			Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate	
					Zone 2 Restrictor	Not Selected
Depth to Invert of Outlet Pipe =	0.00		ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =		ft²
Outlet Pipe Diameter =	12.00		inches	Outlet Orifice Centroid =		feet
Restrictor Plate Height Above Pipe Invert =			Inches	Half-Central Angle of Restrictor Plate on Pipe =		N/A radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

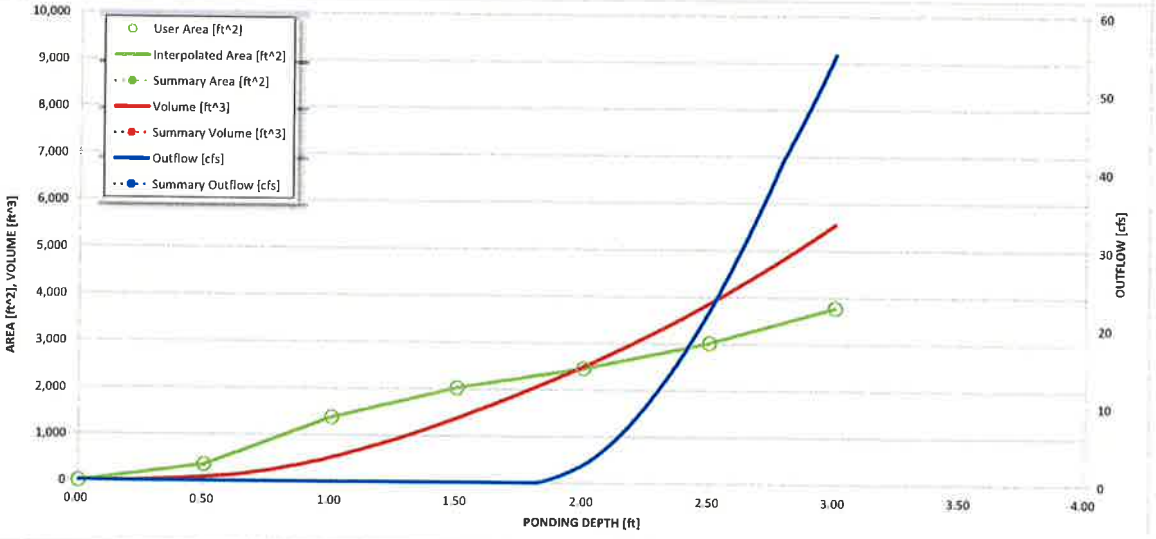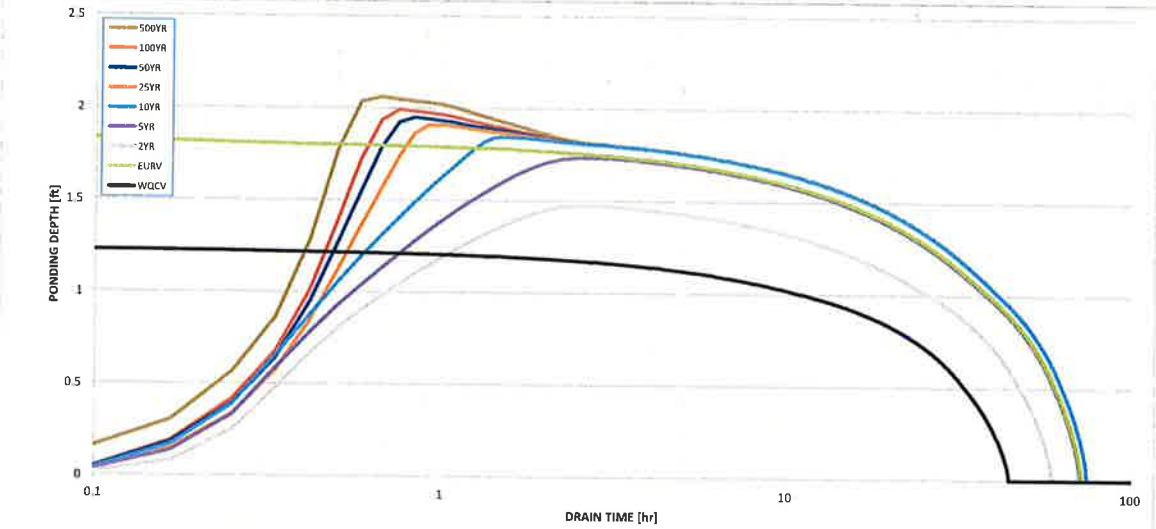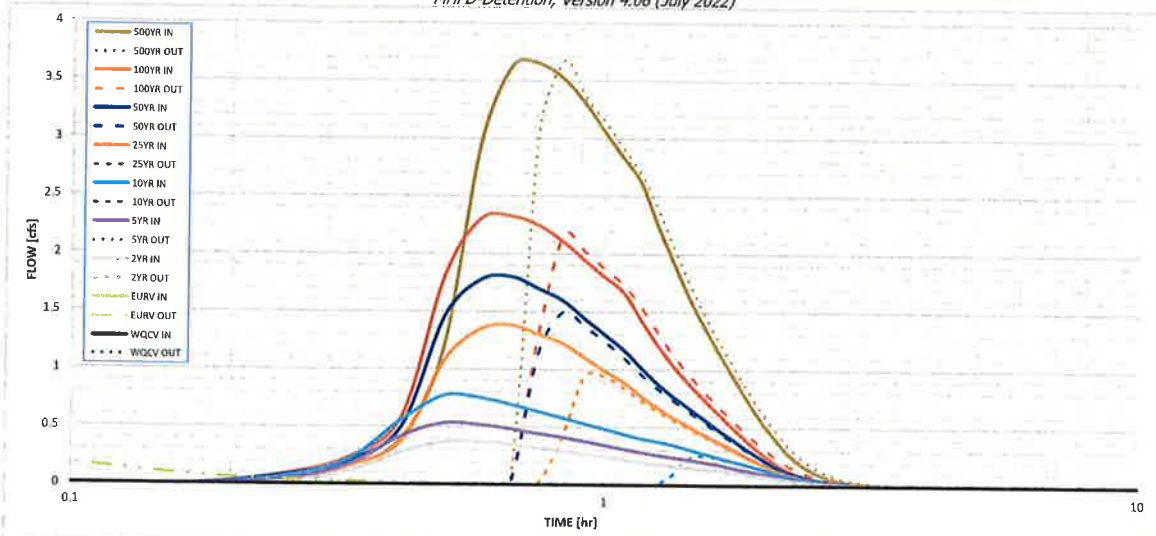|				Calculated Parameters for Spillway	
Spillway Invert Stage =	2.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth =	0.27	feet
Spillway Crest Length =	5.00	feet	Stage at Top of Freeboard =	3.27	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.09	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.13	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.83	1.08	1.32	1.70	2.03	2.40	3.43
CUHP Runoff Volume (acre-ft) =	0.020	0.059	0.033	0.046	0.064	0.106	0.138	0.180	0.287
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.033	0.046	0.064	0.106	0.138	0.180	0.287
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.1	0.6	0.8	1.2	2.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	1.57	2.19	3.24			10.49	
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	1.27	1.77	2.61	0.45	0.68	8.46	1.68
Peak Inflow Q (cfs) =	N/A	N/A	0.4	0.5	0.8	1.4	1.8	2.3	3.6
Peak Outflow Q (cfs) =	0.0	1.4	0.012	0.013	0.260	0.94	1.50	2.16	3.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.0	0.1	1.7	1.8	0.2	1.8
Structure Controlling Flow =	Plate	Spillway	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.00	N/A	N/A	0.0	0.0	0.0	0.0	0.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	63	53	63	64	60	57	54	48
Time to Drain 99% of Inflow Volume (hours) =	43	68	56	68	70	68	66	64	61
Maximum Ponding Depth (ft) =	1.23	2.04	1.48	1.74	1.84	1.91	1.95	1.99	2.06
Area at Maximum Ponding Depth (acres) =	0.04	0.06	0.05	0.05	0.05	0.05	0.06	0.06	0.06
Maximum Volume Stored (acre-ft) =	0.020	0.060	0.030	0.043	0.049	0.052	0.054	0.057	0.061

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Chart 1: FLOW [cfs] vs TIME [hr]

Legend:
- 500YR IN
- 500YR OUT
- 100YR IN
- 100YR OUT
- 50YR IN
- 50YR OUT
- 25YR IN
- 25YR OUT
- 10YR IN
- 10YR OUT
- 5YR IN
- 5YR OUT
- 2YR IN
- 2YR OUT
- EURV IN
- EURV OUT
- WQCV IN
- WQCV OUT

Chart 2: PONDING DEPTH [ft] vs DRAIN TIME [hr]

Legend:
- 500YR
- 100YR
- 50YR
- 25YR
- 10YR
- 5YR
- 2YR
- EURV
- WQCV

Chart 3: AREA [ft^2], VOLUME [ft^3] and OUTFLOW [cfs] vs PONDING DEPTH [ft]

Legend:
- User Area [ft^2]
- Interpolated Area [ft^2]
- Summary Area [ft^2]
- Volume [ft^3]
- Summary Volume [ft^3]
- Outflow [cfs]
- Summary Outflow [cfs]

DETENTION VOLUME BY THE MODIFIED FAA METHOD

Project: Penrose RV & Boat Storage

Basin ID: PND

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing method)
(NOTE: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

Determination of MINOR Detention Volume Using Modified FAA Method

Design Information (Input):

Catchment Drainage Imperviousness	$I_a =$	45.00	percent
Catchment Drainage Area	$A =$	1.240	acres
Predevelopment NRCS Soil Group	Type =	B	A, B, C, or D
Return Period for Detention Control	T =	10	years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5	minutes
Allowable Unit Release Rate	q =	0.23	cfs/acre
One-hour Precipitation	$P_1 =$	1.32	inches

Design Rainfall IDF Formula $I = C_1 \cdot P_1/(C_2+T_c)^{C_3}$

Coefficient One	$C_1 =$	28.50
Coefficient Two	$C_2 =$	10
Coefficient Three	$C_3 =$	0.789

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.38	
Inflow Peak Runoff	Qp-in =	2.09	cfs
Allowable Peak Outflow Rate	Qp-out =	0.29	cfs
Mod. FAA Minor Storage Volume =		1,718	cubic feet
Mod. FAA Minor Storage Volume =		0.039	acre-ft

5 <- Enter Rainfall Duration Incremental Increase Value Here (e.g. 5 for 5-Minutes)

Rainfall Duration minutes (input)	Rainfall Intensity inches / hr (output)	Inflow Volume acre-feet (output)	Adjustment Factor "m" (output)	Average Outflow cfs (output)	Outflow Volume acre-feet (output)	Storage Volume acre-feet (output)
5	4.44	0.014	1.00	0.29	0.002	0.012
10	3.54	0.023	0.75	0.21	0.003	0.020
15	2.97	0.029	0.67	0.19	0.004	0.025
20	2.57	0.033	0.63	0.18	0.005	0.028
25	2.28	0.037	0.60	0.17	0.006	0.031
30	2.05	0.040	0.58	0.17	0.007	0.033
35	1.87	0.042	0.57	0.16	0.008	0.035
40	1.72	0.045	0.56	0.16	0.009	0.036
45	1.59	0.047	0.56	0.16	0.010	0.037
50	1.49	0.048	0.55	0.16	0.011	0.037
55	1.40	0.050	0.55	0.16	0.012	0.038
60	1.32	0.051	0.54	0.15	0.013	0.039
65	1.25	0.053	0.54	0.15	0.014	0.039
70	1.19	0.054	0.54	0.15	0.015	0.039
75	1.13	0.055	0.53	0.15	0.016	0.039
80	1.08	0.056	0.53	0.15	0.017	0.039
85	1.04	0.057	0.53	0.15	0.018	0.039
90	0.99	0.058	0.53	0.15	0.019	0.039
95	0.96	0.059	0.53	0.15	0.020	0.039
100	0.92	0.060	0.53	0.15	0.021	0.039
105	0.89	0.061	0.52	0.15	0.022	0.039
110	0.86	0.061	0.52	0.15	0.023	0.039
115	0.83	0.062	0.52	0.15	0.024	0.039
120	0.81	0.063	0.52	0.15	0.025	0.038
125	0.78	0.064	0.52	0.15	0.026	0.038
130	0.76	0.064	0.52	0.15	0.027	0.038
135	0.74	0.065	0.52	0.15	0.027	0.037
140	0.72	0.066	0.52	0.15	0.028	0.037
145	0.70	0.066	0.52	0.15	0.029	0.037
150	0.69	0.067	0.52	0.15	0.030	0.036
155	0.67	0.067	0.52	0.15	0.031	0.036
160	0.65	0.068	0.52	0.15	0.032	0.036
165	0.64	0.068	0.52	0.15	0.033	0.035
170	0.63	0.069	0.51	0.15	0.034	0.035
175	0.61	0.069	0.51	0.15	0.035	0.034
180	0.60	0.070	0.51	0.15	0.036	0.034
185	0.59	0.070	0.51	0.15	0.037	0.033
190	0.58	0.071	0.51	0.15	0.038	0.033
195	0.56	0.071	0.51	0.15	0.039	0.032
200	0.55	0.072	0.51	0.15	0.040	0.032
205	0.54	0.072	0.51	0.15	0.041	0.031
210	0.53	0.073	0.51	0.15	0.042	0.031
215	0.52	0.073	0.51	0.15	0.043	0.030
220	0.52	0.074	0.51	0.15	0.044	0.029
225	0.51	0.074	0.51	0.15	0.045	0.029
230	0.50	0.074	0.51	0.15	0.046	0.028
235	0.49	0.075	0.51	0.15	0.047	0.028
240	0.48	0.075	0.51	0.15	0.048	0.027
245	0.47	0.076	0.51	0.15	0.049	0.026
250	0.47	0.076	0.51	0.15	0.050	0.026
255	0.46	0.076	0.51	0.15	0.051	0.025
260	0.45	0.077	0.51	0.15	0.052	0.025
265	0.45	0.077	0.51	0.15	0.053	0.024
270	0.44	0.077	0.51	0.15	0.054	0.023
275	0.44	0.078	0.51	0.15	0.055	0.023
280	0.43	0.078	0.51	0.15	0.056	0.022
285	0.42	0.078	0.51	0.15	0.057	0.021
290	0.42	0.079	0.51	0.15	0.058	0.021
295	0.41	0.079	0.51	0.15	0.059	0.020
300	0.41	0.079	0.51	0.14	0.060	0.019
305	0.40	0.080	0.51	0.14	0.061	0.019

Mod. FAA Minor Storage Volume (cubic ft.) = 1,718
Mod. FAA Minor Storage Volume (acre-ft.) = 0.0394

Determination of MAJOR Detention Volume Using Modified FAA Method

Design Information (Input):

Catchment Drainage Imperviousness	$I_a =$	45.00	percent
Catchment Drainage Area	$A =$	1.240	acres
Predevelopment NRCS Soil Group	Type =	B	A, B, C, or D
Return Period for Detention Control	T =	100	years (2, 5, 10, 25, 50, or 100)
Time of Concentration of Watershed	Tc =	5	minutes
Allowable Unit Release Rate	q =	0.85	cfs/acre
One-hour Precipitation	$P_1 =$	2.40	inches

Design Rainfall IDF Formula $I = C_1 \cdot P_1/(C_2+T_c)^{C_3}$

Coefficient One	$C_1 =$	28.50
Coefficient Two	$C_2 =$	10
Coefficient Three	$C_3 =$	0.789

Determination of Average Outflow from the Basin (Calculated):

Runoff Coefficient	C =	0.51	
Inflow Peak Runoff	Qp-in =	5.11	cfs
Allowable Peak Outflow Rate	Qp-out =	1.05	cfs
Mod. FAA Major Storage Volume =		3,402	cubic feet
Mod. FAA Major Storage Volume =		0.078	acre-ft

Rainfall Duration minutes (input)	Rainfall Intensity inches / hr (output)	Inflow Volume acre-feet (output)	Adjustment Factor "m" (output)	Average Outflow cfs (output)	Outflow Volume acre-feet (output)	Storage Volume acre-feet (output)
5	8.07	0.035	1.00	1.05	0.007	0.028
10	6.43	0.056	0.75	0.79	0.011	0.045
15	5.40	0.071	0.67	0.70	0.015	0.056
20	4.67	0.081	0.63	0.66	0.018	0.063
25	4.14	0.090	0.60	0.63	0.022	0.068
30	3.72	0.097	0.58	0.61	0.025	0.072
35	3.39	0.103	0.57	0.60	0.029	0.074
40	3.12	0.109	0.56	0.59	0.033	0.076
45	2.90	0.114	0.56	0.59	0.036	0.077
50	2.70	0.118	0.55	0.58	0.040	0.078
55	2.54	0.122	0.55	0.57	0.044	0.078
60	2.39	0.125	0.54	0.57	0.047	0.078
65	2.27	0.128	0.54	0.57	0.051	0.078
70	2.16	0.131	0.54	0.56	0.054	0.077
75	2.05	0.134	0.53	0.56	0.058	0.076
80	1.96	0.137	0.53	0.56	0.062	0.075
85	1.88	0.139	0.53	0.56	0.065	0.074
90	1.81	0.142	0.53	0.56	0.069	0.073
95	1.74	0.144	0.53	0.55	0.073	0.071
100	1.68	0.146	0.53	0.55	0.076	0.070
105	1.62	0.148	0.52	0.55	0.080	0.068
110	1.57	0.150	0.52	0.55	0.083	0.067
115	1.52	0.152	0.52	0.55	0.087	0.065
120	1.47	0.154	0.52	0.55	0.091	0.063
125	1.43	0.155	0.52	0.55	0.094	0.061
130	1.39	0.157	0.52	0.55	0.098	0.059
135	1.35	0.159	0.52	0.55	0.102	0.057
140	1.31	0.160	0.52	0.55	0.105	0.055
145	1.28	0.162	0.52	0.55	0.109	0.053
150	1.25	0.163	0.52	0.54	0.113	0.050
155	1.22	0.164	0.52	0.54	0.116	0.048
160	1.19	0.166	0.52	0.54	0.120	0.046
165	1.16	0.167	0.52	0.54	0.123	0.044
170	1.14	0.168	0.51	0.54	0.127	0.041
175	1.11	0.170	0.51	0.54	0.131	0.039
180	1.09	0.171	0.51	0.54	0.134	0.036
185	1.07	0.172	0.51	0.54	0.138	0.034
190	1.05	0.173	0.51	0.54	0.142	0.032
195	1.03	0.174	0.51	0.54	0.145	0.029
200	1.01	0.175	0.51	0.54	0.149	0.027
205	0.99	0.176	0.51	0.54	0.152	0.024
210	0.97	0.177	0.51	0.54	0.156	0.021
215	0.95	0.179	0.51	0.54	0.160	0.019
220	0.94	0.180	0.51	0.54	0.163	0.016
225	0.92	0.181	0.51	0.54	0.167	0.014
230	0.91	0.181	0.51	0.54	0.171	0.011
235	0.89	0.182	0.51	0.54	0.174	0.008
240	0.88	0.183	0.51	0.54	0.178	0.006
245	0.86	0.184	0.51	0.54	0.181	0.003
250	0.85	0.185	0.51	0.54	0.185	0.000
255	0.84	0.186	0.51	0.54	0.189	-0.003
260	0.83	0.187	0.51	0.54	0.192	-0.005
265	0.81	0.188	0.51	0.54	0.196	-0.008
270	0.80	0.189	0.51	0.54	0.200	-0.011
275	0.79	0.189	0.51	0.54	0.203	-0.014
280	0.78	0.190	0.51	0.54	0.207	-0.017
285	0.77	0.191	0.51	0.54	0.211	-0.019
290	0.76	0.192	0.51	0.54	0.214	-0.022
295	0.75	0.193	0.51	0.54	0.218	-0.025
300	0.74	0.193	0.51	0.54	0.221	-0.028
305	0.73	0.194	0.51	0.54	0.225	-0.031

Mod. FAA Major Storage Volume (cubic ft.) = 3,402
Mod. FAA Major Storage Volume (acre-ft.) = 0.0781

UDFCD DETENTION BASIN VOLUME ESTIMATING WORKBOOK Version 2.35, Released January 2015

Table 8

PENROSE RV & BOAT STORAGE

DETENTION POND

STAGE - STORAGE TABLE

Stage (ft)	Elevation (ft)	D Elevation (ft)	Area (SF)	Incremental Est. Volume (CF)	Est. Available Volume (CF)	Est. Available Volume (ac-ft)	Note
0	5503.00	0.00	0	0	0	0.000	Outlet Structure Invert
0.50	5503.50	0.50	353	88	88	0.002	-
1.00	5504.00	0.50	1,384	434	522	0.012	-
1.23	5504.23	0.23	2,026				WQCV WSEL
1.50	5504.50	0.50		852	1,375	0.032	-
1.99	5504.99	0.49	2,454				100-yr WSEL
2.00	5505.00	0.50	3,013	1,120	2,495	0.057	Spillway Invert
2.50	5505.50	0.50	3,776	1,367	3,862	0.089	-
3.00	5506.00	0.50		1,697	5,559	0.128	Top of Berm

CIVIL RESOURCES

Outfall

4

Outfall

Outfall

1

3

2

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Pipe - (33)	1.38	8	Cir	89.603	5505.50	5506.13	0.703	5506.05*	5507.11*	0.04	5507.14	End	Manhole
2	Pipe - (32)	1.38	8	Cir	153.000	5506.13	5509.15	1.974	5507.14	5509.70	n/a	5509.70 j	1	OpenHeadwall
3	Pipe - (39)	1.92	18	Cir	42.734	5503.35	5504.54	2.785	5503.87	5505.06	n/a	5505.06	End	OpenHeadwall
4	Pipe - (38)	2.16	12	Cir	47.452	5502.76	5503.00	0.506	5503.39	5503.75	0.18	5503.93	End	OpenHeadwall

Number of lines: 4

Project File: 355.001.02_Penrose_100-year.stm

NOTES: Return period = 100 Yrs ; *Surcharged (HGL above crown) ; j - Line contains hyd. jump.

Run Date: 5/15/2024

Storm Sewer Tabulation

Line	Station To Line	Len (ft)	Drng Area Incr (ac)	Drng Area Total (ac)	Rnoff coeff (C)	Area x C Incr	Area x C Total	Tc Inlet (min)	Tc Syst (min)	Rain (I) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe Size (in)	Slope (%)	Invert Elev Dn (ft)	Invert Elev Up (ft)	HGL Elev Dn (ft)	HGL Elev Up (ft)	Grnd/Rim Elev Dn (ft)	Grnd/Rim Elev Up (ft)	Line ID
1	End	89.603	0.00	0.00	0.00	0.00	0.00	0.6	0.0	0.0	1.38	1.10	4.21	8	0.70	5505.50	5506.13	5506.05	5507.11	0.00	5508.62	Pipe - (33)
2	1	153.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.38	1.84	4.21	8	1.97	5506.13	5509.15	5507.14	5509.70	5508.62	5511.63	Pipe - (32)
3	End	42.734	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	1.92	17.52	3.52	18	2.78	5503.35	5504.54	5503.87	5505.06	5505.14	5506.33	Pipe - (39)
4	End	47.452	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	2.16	2.53	3.80	12	0.51	5502.76	5503.00	5503.39	5503.75	0.00	5504.88	Pipe - (38)

Project File: 355.001.02_Penrose_100-year.stm

Number of lines: 4

Run Date: 5/15/2024

NOTES: Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82; Return period = Yrs. 100 ; c = cir e = ellip b = box

Storm Sewer Profile

Elev. (ft)

Reach (ft)

HGL
EGL

Sta 0+00.00 - Outfall
Grnd. El. 5510.17
Inv. El. 5505.50 In

Sta 0+89.603 - Ln: 1
Rim El. 5508.62
Inv. El. 5506.13 Out
Inv. El. 5506.13 In

STORM CLEANOUT

89.603Lf - 8" @ 0.70%

153.000Lf - 8" @ 1.91%

Sta 2+42.603 - Ln: 2
Grnd. El. 5511.63
Inv. El. 5509.15 Out

STORM CLEANOUT

Elev. (ft)

—— HGL

—— EGL

Reach (ft)

42.734 Lf. - 18" @ 2.78%

Sta 0+00.00 - Outfall
Grnd. El. 5505.14
Inv. El. 5503.35 In

Sta 0+42.734 - Ln: 3
Grnd. El. 5506.33
Inv. El. 5504.54 Out
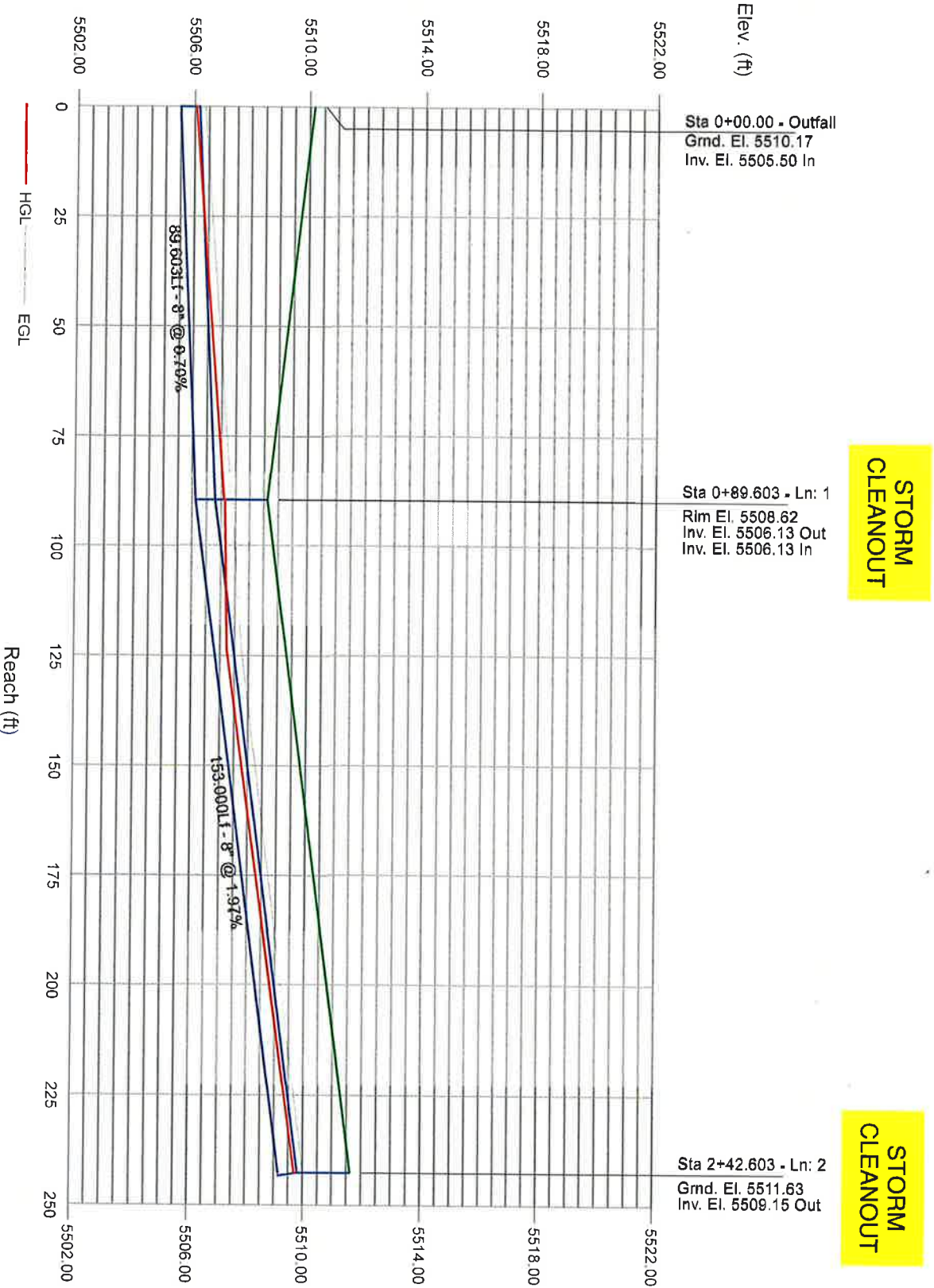
18" FLARED
END SECTION

Proj. file: 355.001.02_Penrose_100-year.stm

Elev. (ft)

5515.00
5512.00
5509.00
5506.00
5503.00
5500.00

HGL

EGL

Sta 0+00.00 - Outfall
Grnd. El. 5507.76
Inv. El. 5502.76 In

47.452Lf - 12" @ 0.51%

POND
OUTLET

Sta 0+47.452 - Ln: 4
Grnd. El. 5504.88
Inv. El. 5503.00 Out

Reach (ft)

5515.00
5512.00
5509.00
5506.00
5503.00
5500.00
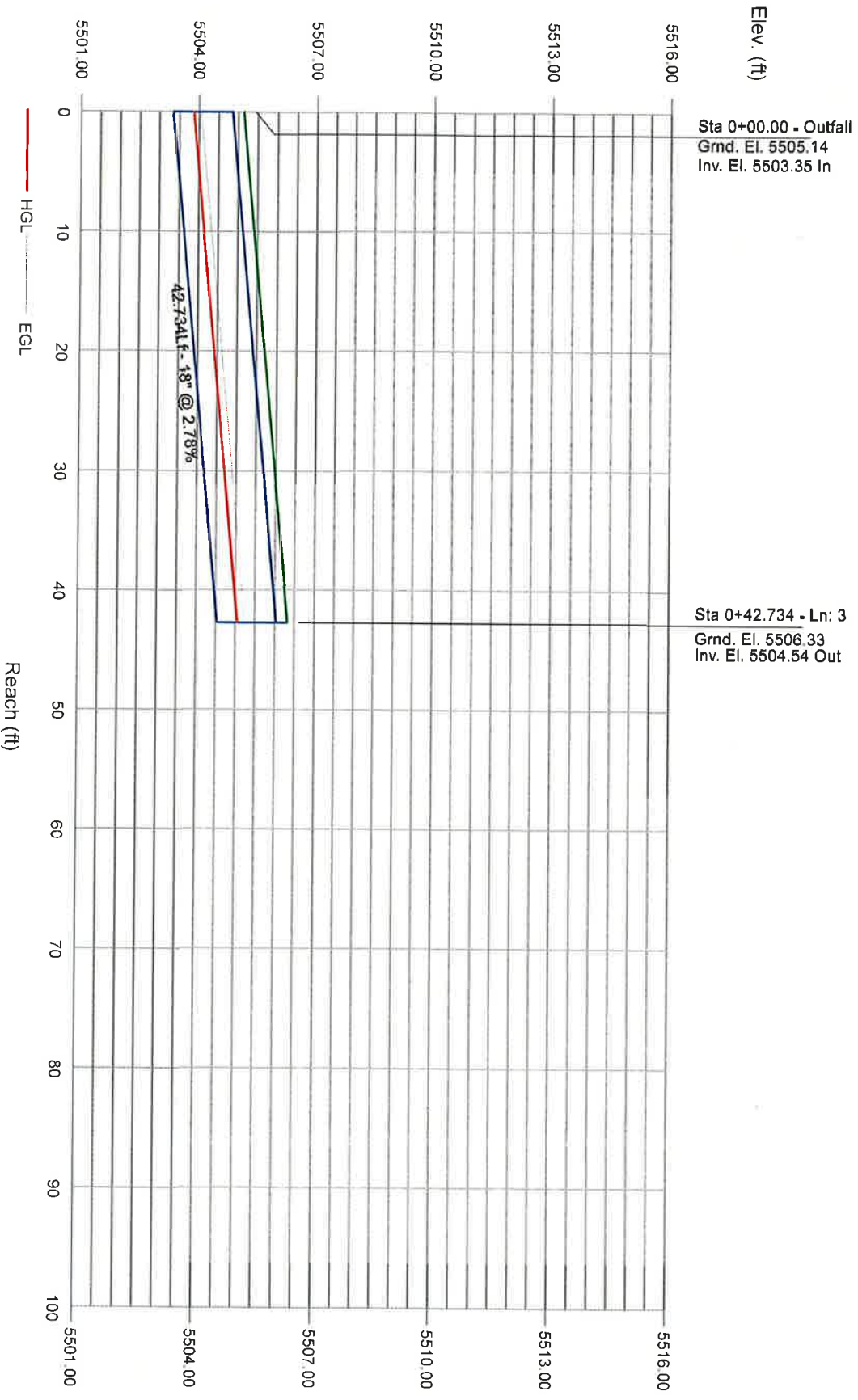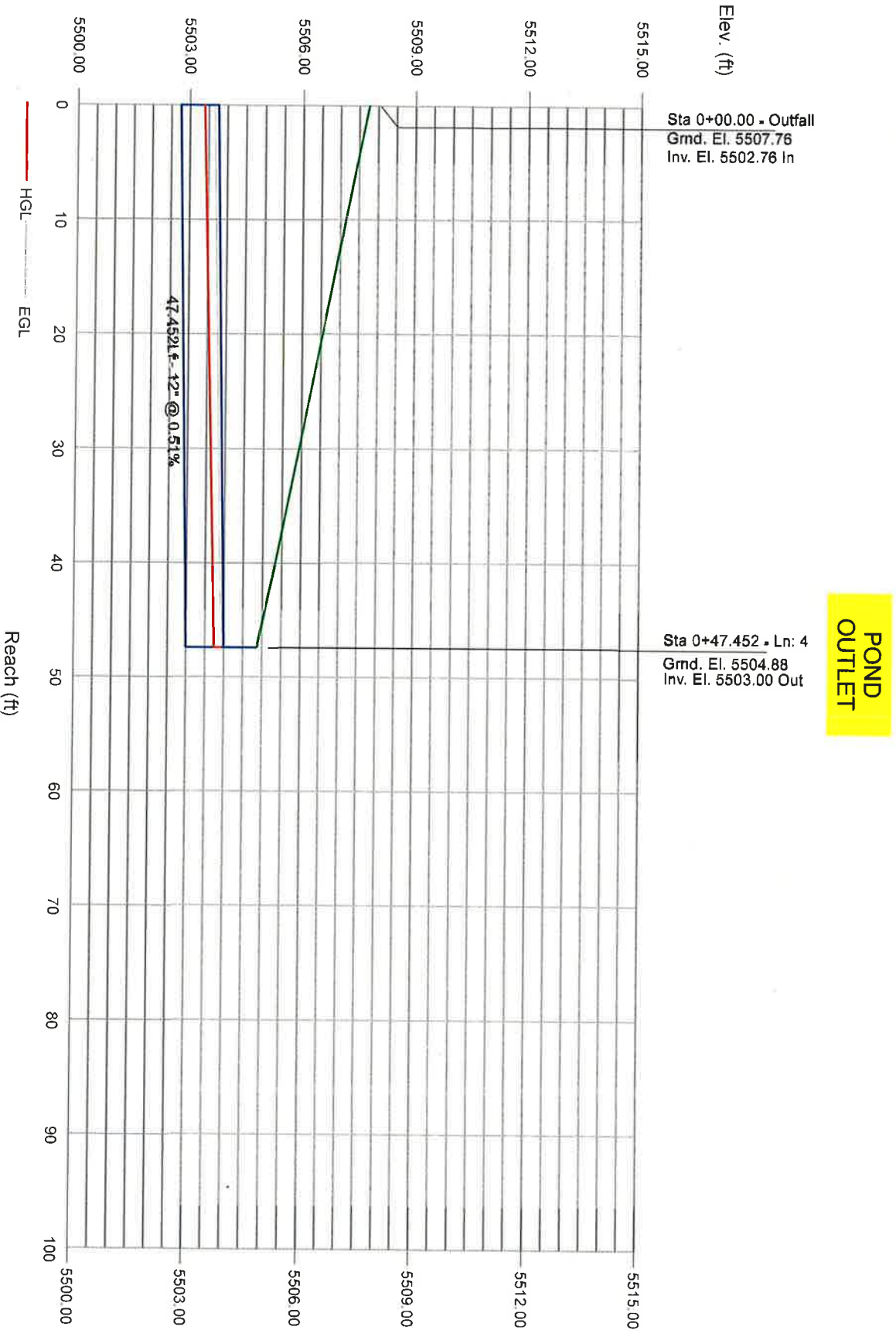
Table 9

Detention Pond

SPILLWAY & RIPRAP SIZING

Parameter	Description	Value
[1]C_{BCW}	broad-crested weir coefficient	3.10
Z (ft)	side slopes (horiz:vert)	4.00
L (ft)	broad-crested weir length	5.00
H (ft)	head above weir crest	0.23
S (%)	longitudinal slope	10.80
[2]Q_H (cfs)	horizontal discharge	5.35
[3]Q_S (cfs)	sloping discharge	0.25
Q (cfs)	total discharge	5.60
q (cfs/ft)	unit discharge	1.12
[1]d_{50} (in)	riprap mean particle size	6.00

[1] C_{BCW} ranges 2.6-3.0; 3.0 is typical (USDCM 5.14.2)

[2] $Q = C_{BCW} L H^{1.5}$ (Eq. 12.8 USDCM)

[3] $Q = 2(2/5) C_{BCW} Z H^{2.5}$ (Eq. 12.9 USDCM)

[1] d_{50} (Fig. 12-21 USDCM)
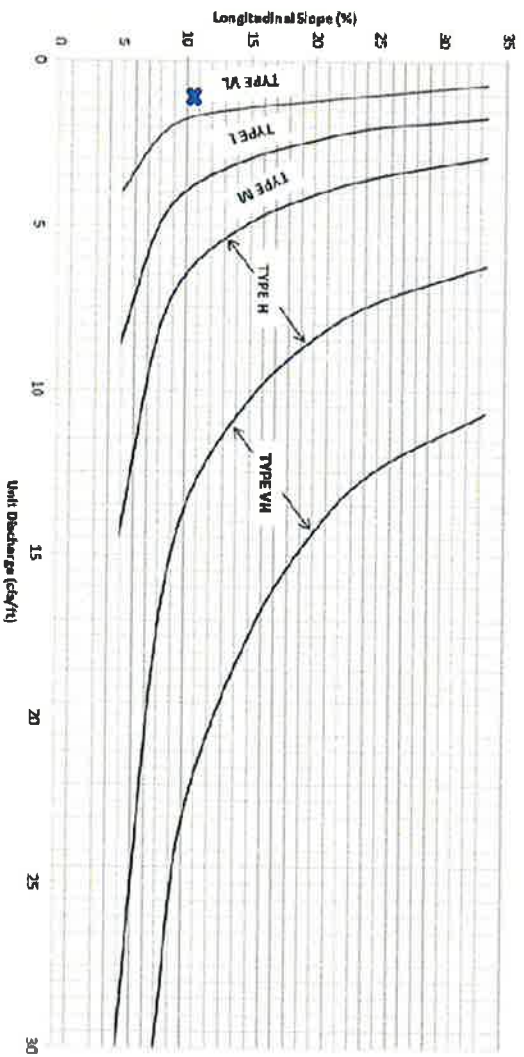
Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

APPENDIX D

Drawings

FUTURE H STREET
(25 R.O.W.)

STATE HIGHWAY 115
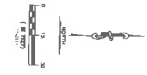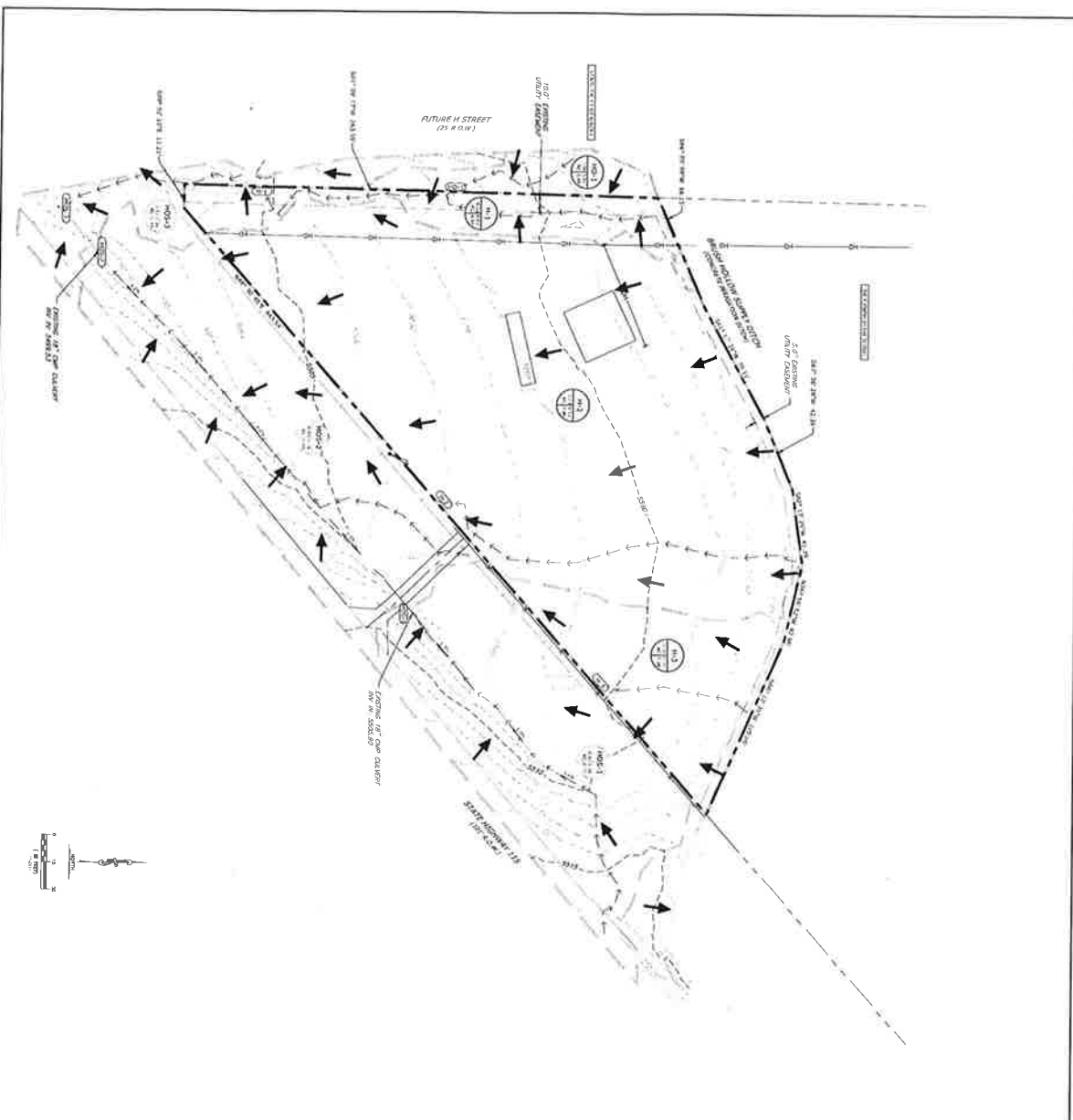
LEGEND

EXISTING

PROPERTY LINE	
MAJOR CONTOUR	
MINOR CONTOUR	5208
EASEMENT	
FENCE/GUARDRAIL	
SWALE CENTERLINE	
STORM SEWER	
SLOPE & FLOW DIRECTION	
DRAINAGE BASIN BOUNDARY	
DRAINAGE BASIN FLOW PATH	
DRAINAGE BASIN DESIGN POINT	
DRAINAGE BASIN IDENTIFICATION	
RUNOFF COEFFICIENTS (10-YR & 100-YR)	
DRAINAGE BASIN AREA (ACRES)	

RUNOFF SUMMARY TABLE

811
Know what's below.
Call before you dig.

LOT 2 COYLE-VANEGMOND LOT LINE
ADJUSTMENT
PENROSE, FREMONT COUNTY, CO

HISTORIC
DRAINAGE PL

SHEET
D-1

COMMERCIAL DEVELOPMENT PLAN FOR

PENROSE RV & BOAT STORAGE

LOT 2, COYLE-VANEGMOND LOT LINE ADJUSTMENT, LOCATED WITHIN THE NW $\frac{1}{4}$ OF SECTION 28,
TOWNSHIP 18 SOUTH, RANGE 68 WEST OF THE 6TH PRINCIPAL MERIDIAN, FREMONT COUNTY, COLORADO

LEGEND

	PROPOSED	EXISTING
PROPERTY LINE		
MAJOR CONTOUR	5240	5240
MINOR CONTOUR	5238	5238
EASEMENT		
SETBACK		
FENCE/GUARDRAIL		
ROAD BASE		
ASPHALT		
CONCRETE		
BUILDING		
SWALE CENTERLINE		
STORM SEWER		
SLOPE & FLOW DIRECTION		
DRAINAGE BASIN FLOW PATH		
DRAINAGE BASIN BOUNDARY		
DRAINAGE BASIN DESIGN POINT		
DRAINAGE BASIN IDENTIFICATION		
RUNOFF COEFFICIENTS (10-YR & 100-YR)		
DRAINAGE BASIN AREA (ACRES)		

FUTURE H STREET

CIVIL RESOURCES

INFINITY CONSTRUCTORS

COMMERCIAL DEVELOPMENT PLAN
LOT 2 COYLE-VANEGMOND LOT LINE
ADJUSTMENT
PENROSE, FREMONT COUNTY, CO

DRAINAGE PL.